WILD WORLD OF ANIMALS

ZOOLOGICAL SOCIETY OF SAN DIEGO

Join us here...

...to contemplate the wild animals
of the world and nature's wilderness.

...to strengthen a commitment to wildlife
conservation throughout the world.

...and to strive toward Man's own survival
through the preservation of nature.

San Diego Wild Animal Park...1972

San Diego WILD ANIMAL PARK

WILD WORLD OF ANIMALS

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TEXT BY ROBERT GRAY

HANDY GUIDE MAPS ON PAGES 2, 3 AND CENTER SPREAD

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VIEWING OF WILD ANIMALS

Opposite, the Greater Kudu, an
African antelope. *Above,* the Ga-
apagos Tortoise. This 500-pound
reptile is the longest lived animal on
earth with a lifespan which exceeds
one hundred years. It is found only
on the Galapagos Islands off the
west coast of South America.
Upper right, the Laysan Teal. A
duck which lives on a small island
n the Hawaiian chain. It came dan-
gerously close to extinction after
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and and they ate the ground cover.
Lower right, Przewalski's Horse.
An ancestor of domestic horses.
t is a native of Mongolia, but prob-
ably no longer exists in the wild.

A New Experience

IN OPEN SPACE VIEWING OF WILD ANIMALS

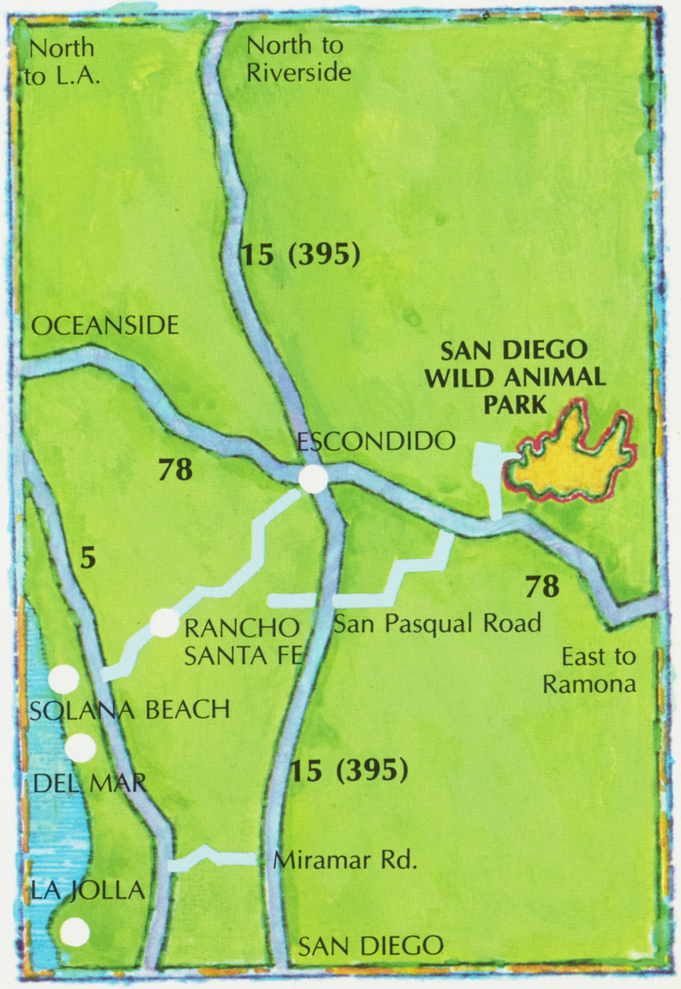
The San Diego Wild Animal Park is an 1800 acre reserve where many species of wild animals can be seen in surroundings much like those of their native homelands. The Park offers superb family entertainment.

But it is more than entertainment, for important scientific research to help save endangered species is conducted at the Park. Many of the species on exhibit are disappearing in the wild. If they are to be saved, we must learn more about their behavior, specifically, reproductive behavior. At the Wild Animal Park's research center, scientists are studying the problems of captive breeding.

The Zoological Society of San Diego has a long history in conservation. Since its founding, the Society has given high priority to the conservation of animals and the wilderness places in which they live. The Society was founded in 1916 and its famous Zoo in 1922, using animals exhibited at the Pan American Exposition. From that modest beginning, the Society has developed the Zoo into one of the world's finest. And during all the years of growth, special attention has been paid to those species labelled "Endangered." The Zoo has had considerable success breeding the world's longest lived animal, the Galapagos Tortoise. In cooperation with other institutions, the Zoo has worked to save animals such as the Laysan Teal, a small duck found only on one island in the Hawaiian chain. Currently, the Zoo is breeding the Przewalski's Horse which is almost extinct in the wild. Stud books for the Anoa and Scimitar-horned Oryx are maintained by the Zoo.

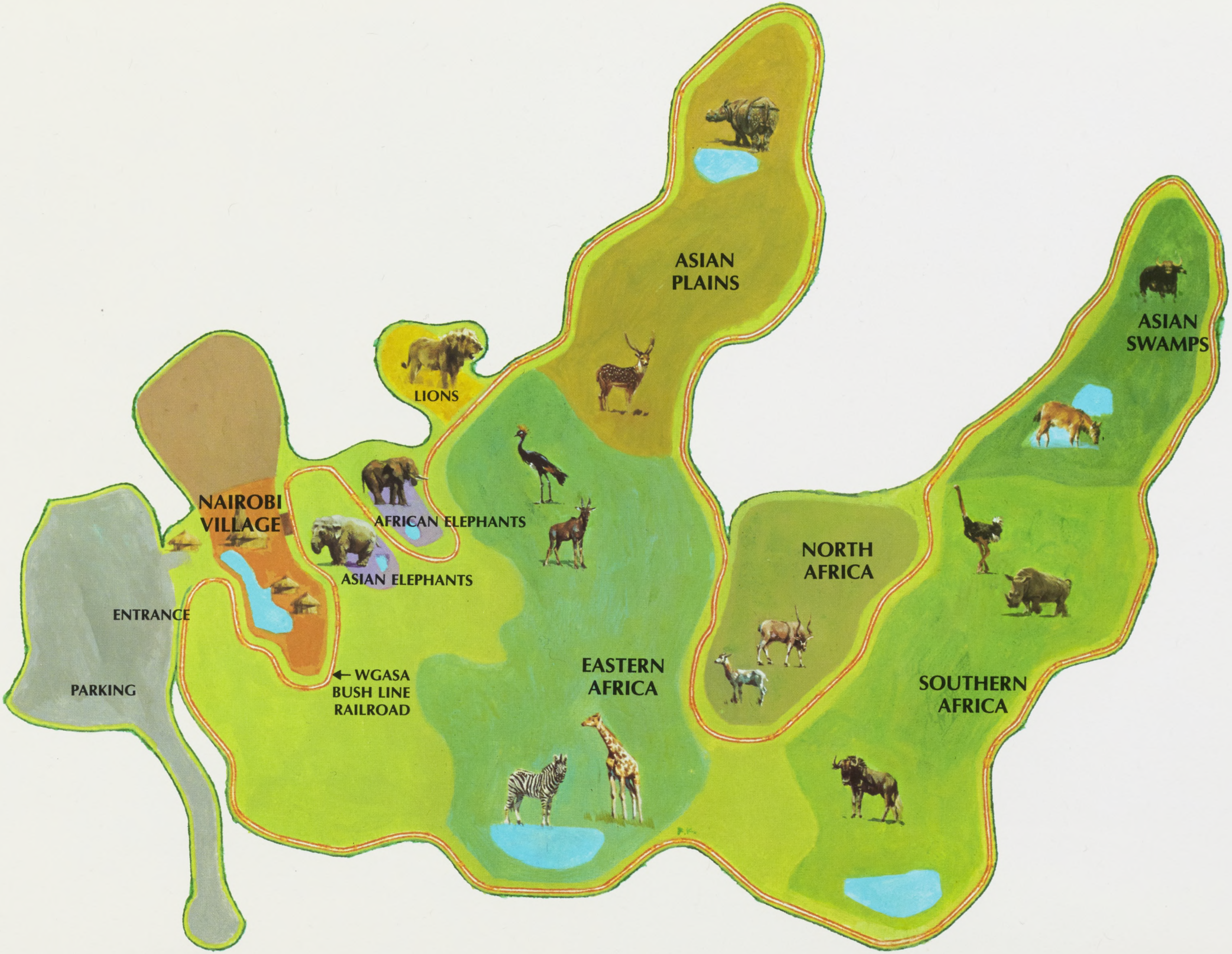
So, establishment of the Wild Animal Park and its research center was a logical step in the Zoological Society's conservation work. Through the cooperation of the Society and the citizens of San Diego, the park opened in May, 1972, the realization of a ten-year effort.

Opposite, the Greater Kudu, an African antelope. *Above,* the Galapagos Tortoise. This 500-pound reptile is the longest lived animal on earth with a lifespan which exceeds one hundred years. It is found only on the Galapagos Islands off the west coast of South America. *Upper right,* the Laysan Teal. A duck which lives on a small island in the Hawaiian chain. It came dangerously close to extinction after whalers brought rabbits to the island and they ate the ground cover. *Lower right,* Przewalski's Horse. An ancestor of domestic horses. It is a native of Mongolia, but probably no longer exists in the wild.



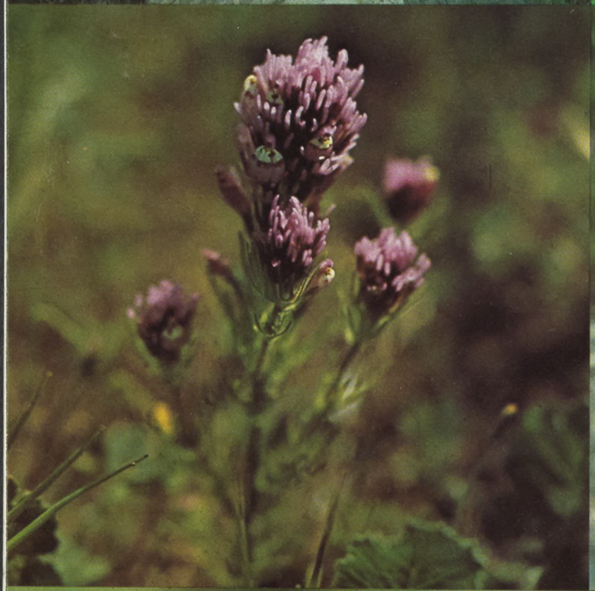
The Setting

The San Diego Wild Animal Park is located in San Pasqual Valley, thirty miles north of the Zoo in Balboa Park, yet still inside the city limits. The valley is farmland primarily. Santa Ysabel creek, in the valley's bottomland, is a typical Southern Californian watercourse—bone-dry for most of the year. But in the rainy season, the stream bed can fill. In former years, it often overflowed. Before the city's utility department built Sutherland Dam fifteen miles upstream, bridges were ripped away, farms were flooded and, much to the delight of the children, the old, one-room San Pasqual school was isolated and closed for days at a time. The hills which flank the valley are part of the Coast Range, a chain of mountains which extends the length of the state. Along its lower reaches, the Coast Range is covered by brush that is pierced by granitic escarpments and divided by dry stream beds. This is chaparral country. Chaparral is a word derived from the Spanish, *chaparro*, the name for scrub oak which makes up much of the ground cover. Spanish cowboys—the *vaqueros*—devised tough leather leggings to protect themselves from the scrub oak's thorns. These leggings became known as chaps. Despite the extensive changes which man has brought to California, chaparral still covers several million acres and


ASIAN PLAINS
ASIAN SWAMPS
LIONS
NAIROBI VILLAGE
AFRICAN ELEPHANTS
ASIAN ELEPHANTS
NORTH AFRICA
ENTRANCE
EASTERN AFRICA
SOUTHERN AFRICA
PARKING
← WGASA BUSH LINE RAILROAD
HIGHWAY 78

is the state's most extensive forest-type ground cover. But this is a dwarf forest, for one of the obvious characteristics of chaparral is its pygmy size. The tallest plants seldom grow taller than twenty feet, and most are appreciably shorter. Probably, this is an adaptation to the semi-arid California hillsides. Another characteristic adaptation of chaparral to its dry environment is its leaves. Most are small, tough and leathery, which reduces the loss of moisture through evaporation. The most vigorous plant growth is in winter—the wet season. From November through April, the chaparral sends out new branchelets and leaves; it blooms, then slips into an almost dormant condition to wait out the hot, dry summer. It is during these summer months that the greatest natural threat comes to the chaparral, fire. As the chaparral dries, it becomes a tinder box. Each year Southern California experiences widespread chaparral fires. Some burn so vigorously that they generate their own fire storms—great drafts of extremely hot air which dry the countryside and sweep the flames through it. Yet, just as it has adapted to the other conditions in its environment, the chaparral copes with fire. The burned-over hillside you see in late autumn already is regenerating itself. The heat of the fire cracked open the tough shells of countless seeds, and a few weeks after the first winter rains, new grass shows through the ashes. Many of the bushes, burned into black skeletons, will send up new sprouts from their roots. In a year or two, the old bushes look like bleached-out skeletons enveloped by fresh, green offspring.

Dodder, beautiful parasite of the chaparral. This relative of the morning glory is widespread in temperate parts of the earth. It has no roots or leaves and lives by twining itself around the host plants from which it extracts water and nourishment.



Yucca

Burr Clover and Filarec

Owl's Clover

Bush Monkey-Flower

Plants of the Chaparral

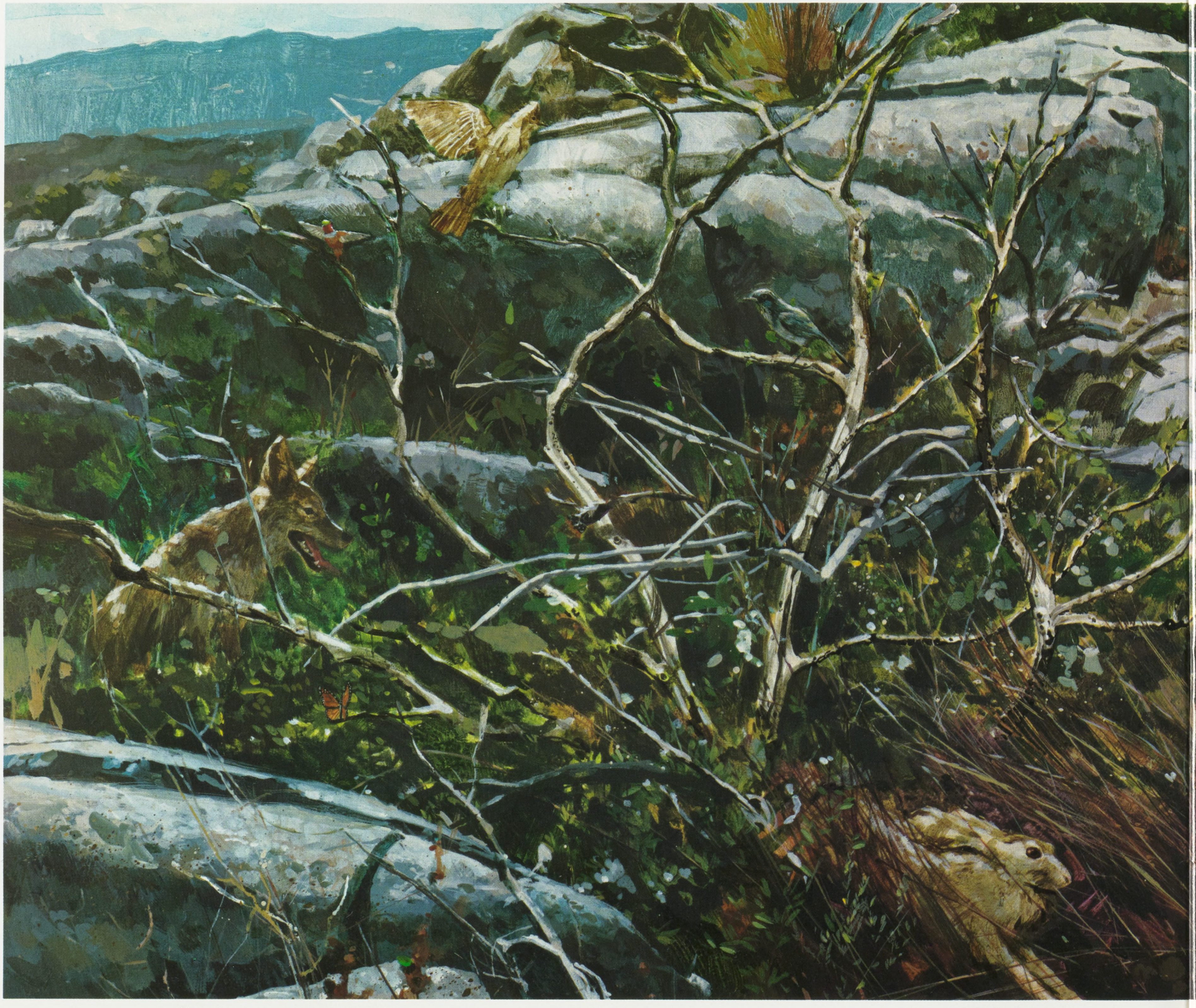
Scrub oak, whose acorns were a mainstay in the Indians' diet. Manzanita, "little apples", named by the Spanish for the small, apple-like berries. Squawbush, whose small branches were woven into baskets by the Indians. Poison oak, whose oil is irritating to many people who contact it. *Yerba santa,* "sacred plant," with wonderous medicinal properties. Ceanothus, also known as wild lilac. Toyon, the Christmasberry. Holly-leaved cherry. Mountain mahogany. Laurel sumac. Black sage. Chemise. Greasewood. Many wild flowers grow in the dense shade of the chaparral. One of the most spectacular blooms is put out by a yucca which drives a spike heavenward. At the tip of the spike a snow-white flower bursts out. This yucca is called "Candle of the Lord." The chaparral is home to many wild animals. Because it has such an extensive south-to-north range—Baja California to southern Oregon—and grows from almost sea level to an elevation of one mile in the southern part, no one area of chaparral is truly typical of all areas. But the animals native to San Pasqual are representative of most Southern California chaparral. There are hundreds of life forms at San Pasqual—plant and animal. Together, they form a community. It is an ancient community where, over tens of thousands of years, all the relationships have been worked out—who shall eat whom; who shall grow in another's shade; what system of energy exchanges shall exist in any given segment of the community. There is a name for this incredibly complex relationship of living things. It is called "ecology."

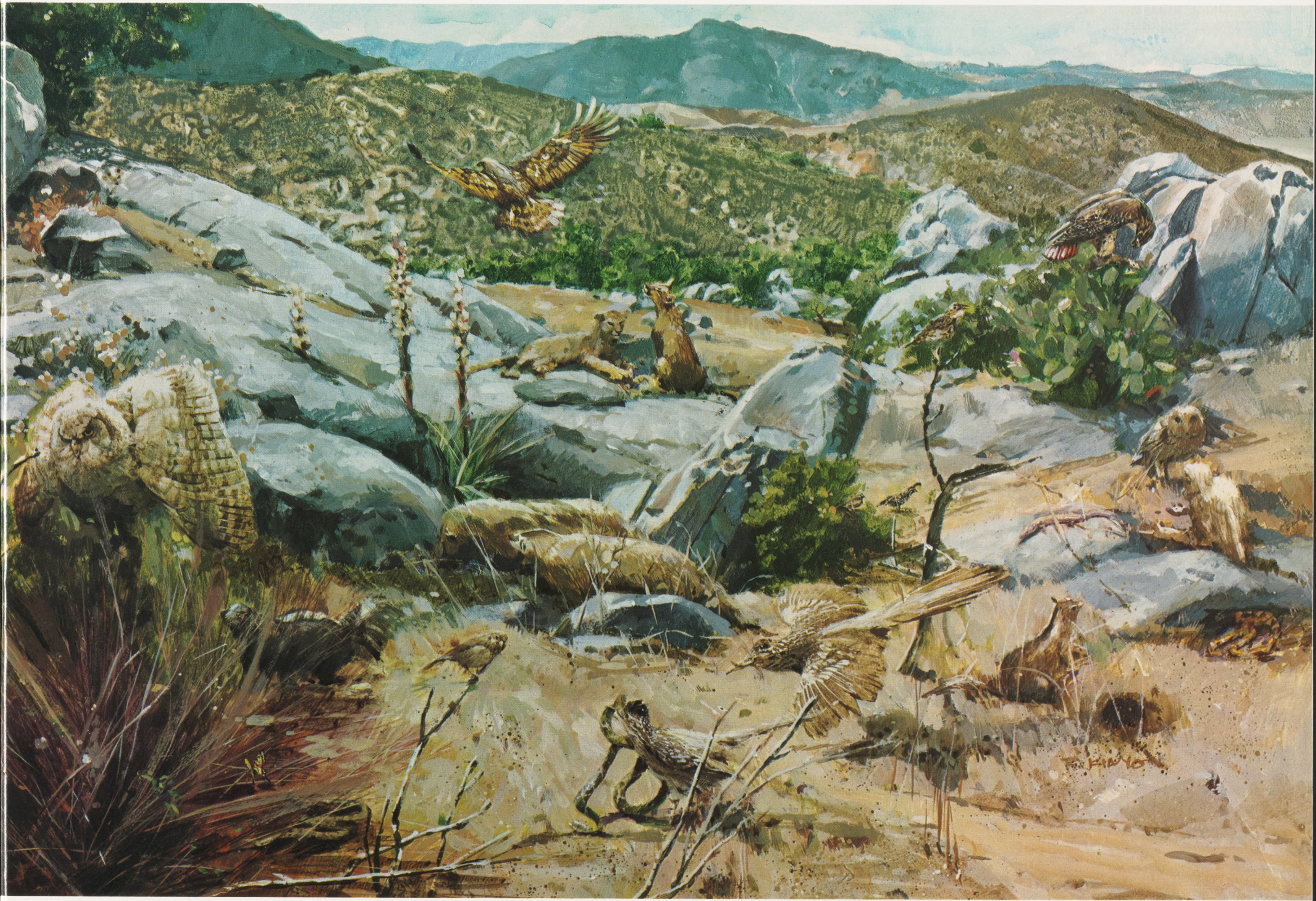
Phacelia

Red Maids

California Poppy and Red Maids

A spring morning in Southern California's Coast Range. Here, in a setting much like that of the San Diego Wild Animal Park, the artist has pictured many of the chaparral's animals. Some, such as the road runner and red-tailed hawk, are eating their prey. Others, including the coyote, great horned owl and badger are hunting. Still others — the monarch and swallow-tailed butterflys, alligator lizard and mountain lions — bask in the warm, spring sunshine. The bleached skeleton of a burned sumac juts from the tangle of the chaparral. Already, new growth rises, Phoenix-like, from its roots. In the background, a typical Coast Range hillside breaks the horizon, the chaparral pierced by huge outcroppings and boulders of granite. This scattering of white rock is called "wool sack."



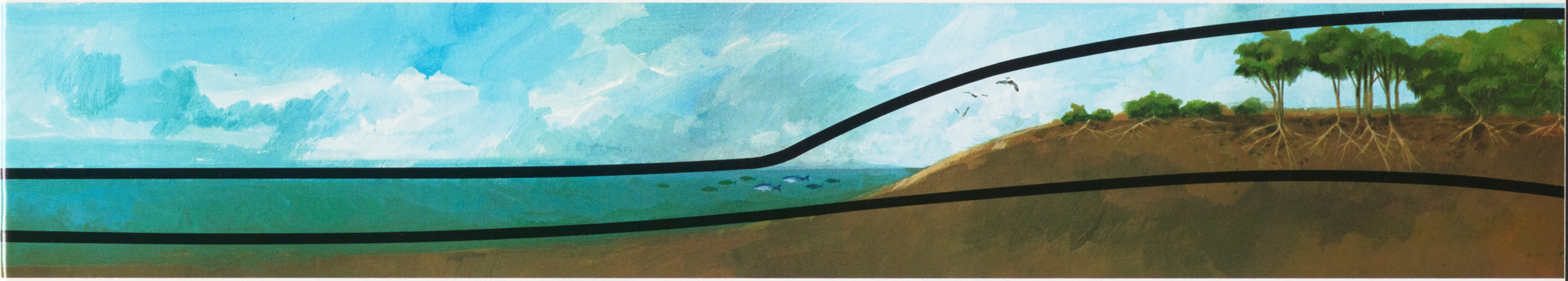

Fence Swift Lizard
Golden Eagle
Mountain Lion
Mule Deer
California Valley Quail
Meadowlark
Alligator Lizard
Red Tailed Hawk
Opossum
Barn Owl
Great Horned Owl
Swallow-tailed Butterfly
Striped Skunk
Gopher Snake
Brown Towhee
Badger
Rattlesnake
Road Runner
California Ground Squirrel
California King Snake

Ecology

MORE WORDS ABOUT AN OVERWORKED WORD

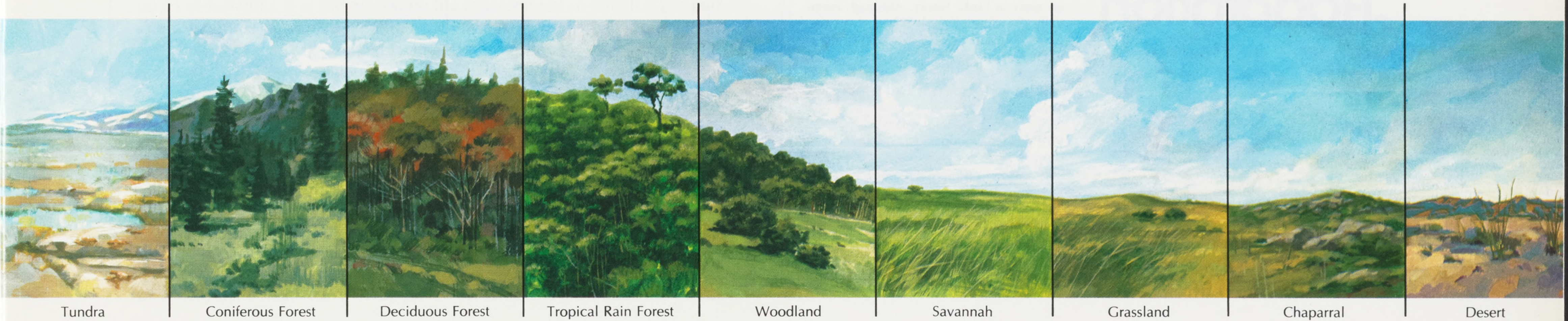
To many people, nature exists outside themselves. It is a "thing," changeless and stable. In reality, nature is not a "thing" at all. It is a process, and is in constant change. By and large, however, these changes occur very slowly, taking far longer than one human lifetime. So we are not aware of them. For instance, we refer to the "eternal mountains," ignoring the actions of wind, rain, snow and ice that are constantly gnawing them away. We speak of the "endless sea," as though the ocean went on forever. But the sea is steadily, slowly, changing its shorelines. Millions of years ago, it washed back and forth across the plains of Kansas and Nebraska. Millions of years hence, it could cover them again. Nothing in nature is static. Another misconception we have regarding nature is that it consists of many, unrelated parts. Thus, we assume that a mountain stands apart from the plain which lies at its foot, and that the two have nothing in common. We imagine that plants have nothing to do with animals; that animals exist apart from each other. We even assume that man is apart from everything else, a special being who stands above the laws which govern the rest of life. The truth is that nothing exists in isolation. Everything is linked to other things. Even man does not stand aside from the destiny which shapes and guides the approximately one and one-half million different life forms—plant and animal—on earth. It is as though all life were a woven fabric and its various components were the warp and woof. No one thread *is* the fabric, yet each contributes to making the whole. The scientific study of these living relationships is called ecology. The word derives from two Greek words—*oikos,* meaning "the home," and *logos,* one translation of which is "rational principle." So ecology can be said to be the rational principle of the home. "Home" in this case refers to the entire earth. In practice, ecology is the science which studies organisms as they relate to each other and their environment. To a growing number of people, it is seen as one of the most important of all sciences because at the heart of its studies is the very matter of survival. In order to grasp something of the vital nature of ecology, it is necessary to introduce a few terms. The first is "biosphere." The biosphere is that part of our planet which is available for life. On land, the biosphere extends into the ground as deep as the tree roots. At sea, it goes to the bottom of the deepest trench, but the majority of marine life lives in the top few hundred feet of water. The biosphere reaches into the air only to the tops of the tallest trees, for although birds and some insects fly much higher, they must come down to feed and rest. So the biosphere covers the planet like a very thin envelope. In the desert, it extends about six feet below ground and fifteen to twenty feet in the air. In more moist areas such as California's redwood forests, it goes fifteen or twenty feet underground and aloft to the tops of the trees, about 375 feet. The desert and redwoods (a coniferous forest) comprise two of nine land areas known as "biomes." Each biome is a geographical area that has its own pattern of rainfall, temperatures, its own seasons and its own unique hours of daylight. These factors—rainfall, temperature, season and the hours of daylight—plus soil types, determine what plants shall grow in a biome. The plants, in turn, are major factors in establishing the biome's animals. The nine major land biomes are: tropical rain forest, coniferous forest, deciduous forest, grassland, savannah, woodland, chaparral, tundra and desert. A biome is too large a geographical division in which to conduct thorough investigations of relationships. Within any one of them are too many variables. Rainfall can be slightly heavier in one section than in another; temperatures can average lower in shaded areas than in direct sunlight; soil types might vary slightly. These differences, small as they are, exert tremendous influences. In order to study an area thoroughly, we need other reference points. So we group together the types of plants and animals which live in a given local situation. The result is called a "biotic community," and the physical environment in which this community exists is called its "habitat." An organism's physical needs determine precisely where in the community and habitat the organism fits. This place, uniquely the organism's own, is called its "ecological niche."

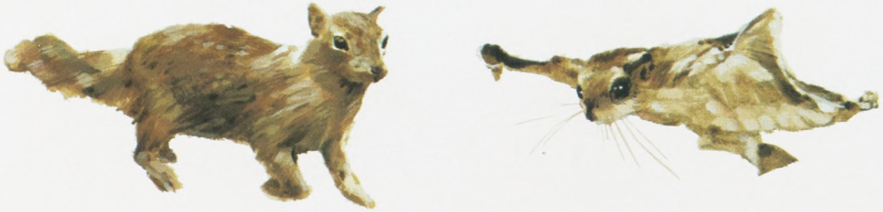
The Biosphere



The biosphere—an exceedingly thin envelope containing all life support systems of spaceship Earth. We arbitrarily partition the biosphere into biomes—the major divisions of floral and faunal life.

The Biome

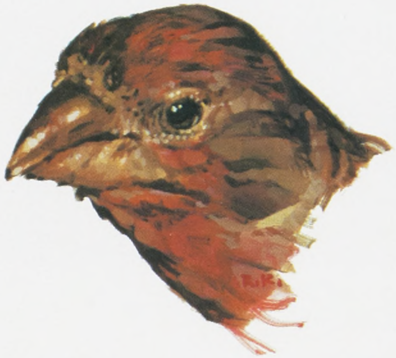




Most squirrels clamber through the trees by clinging with their claws. But a few have developed still another way to adapt to tree life. They have developed a web of skin which can be spread to act as a glide membrane, allowing the squirrel to fly from one branch to another.

Adaptation

Adaptation to different feeding habits can be seen in birds' beaks. Although essentially the same physiological feature, they vary widely in size and shape. (1) House finch. A short, stout beak adapted to cracking seeds. (2) Robin. A slender beak for probing for worms. (3) Red-tailed hawk. The hooked beak of a raptor, or predaceous bird, adapted for ripping away meat. (4) Pileated woodpecker. A hard, chisel-shaped beak for cutting into trees after insects. (5) Flamingo. A beak adapted for sifting small organisms from muddy water. (6) Anhinga. A spear-like beak for impaling fish. (7) Tawny Frogmouth. A beak adapted to scoop insects from the air while the bird is flying. (8) Hummingbird. A long, slender beak for probing deep into blossoms to get nectar.



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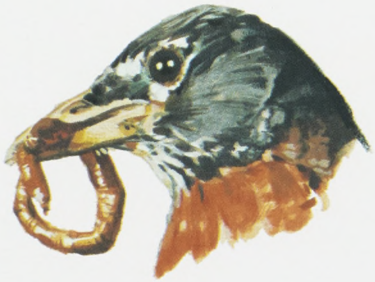

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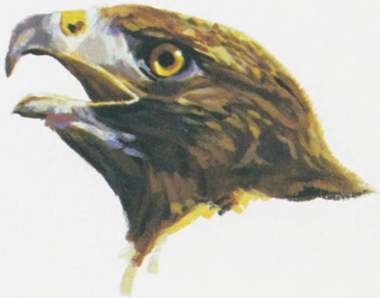

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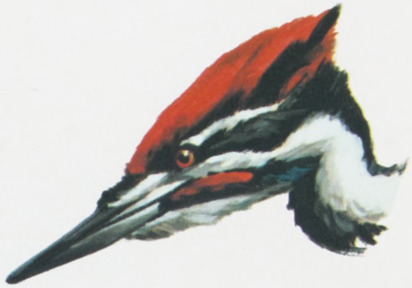

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In the three billion years of life's existence, almost every conceivable niche in the biosphere has been filled. The animals and plants fit into them through a process called "adaptation," the alteration of physical features and life habits to accommodate the niche. The many different birds' beaks, for instance, are the result of adaptation to different feeding habits.

Another example of adaptation to special niches is found in life among the trees. Most squirrels, for instance, clamber around quite well by using claws to dig into the bark. But certain other squirrels extend their range by growing flaps of skin which can be stretched to make "wings" for gliding from one tree to another.

Monkeys and their relatives—the primates—took their own evolutionary direction in adapting to tree life. Instead of relying on claws, they developed hands which could grasp branches. To further protect themselves from falling, they developed depth perception. These two features—the grasping hand and the ability to judge depth—proved invaluable tools when a certain primate, as yet we do not know who, dropped from the trees and left the forest walking upright.

As an organism—plant or animal—adapts to its ecological niche, it does not do so in isolation. It is influenced by the environment of which it is a part. There are three basic ways that the organisms in a biotic community interact—they compete, cooperate or are neutral regarding each other.

Competition is the most obvious way. In Charles Darwin's early work, he claimed that species survive and evolve through natural selection, that is, by competing. Countless examples can be found in nature. Trees compete for sunlight. Animals compete for food and for a mate. In nature, success is measured by survival, individually and as a species. Everything else is window dressing.

But excessive competition can divert energy away from the organism's prime function—to survive. Too much time spent in fighting competitors leaves too little for breeding. So sometimes, species find that it is better to relate in another way. They cooperate.

Many flowering plants lure insects and other creatures by offering them nectar. In return, the insects carry away pollen which cross-pollinates the plants.

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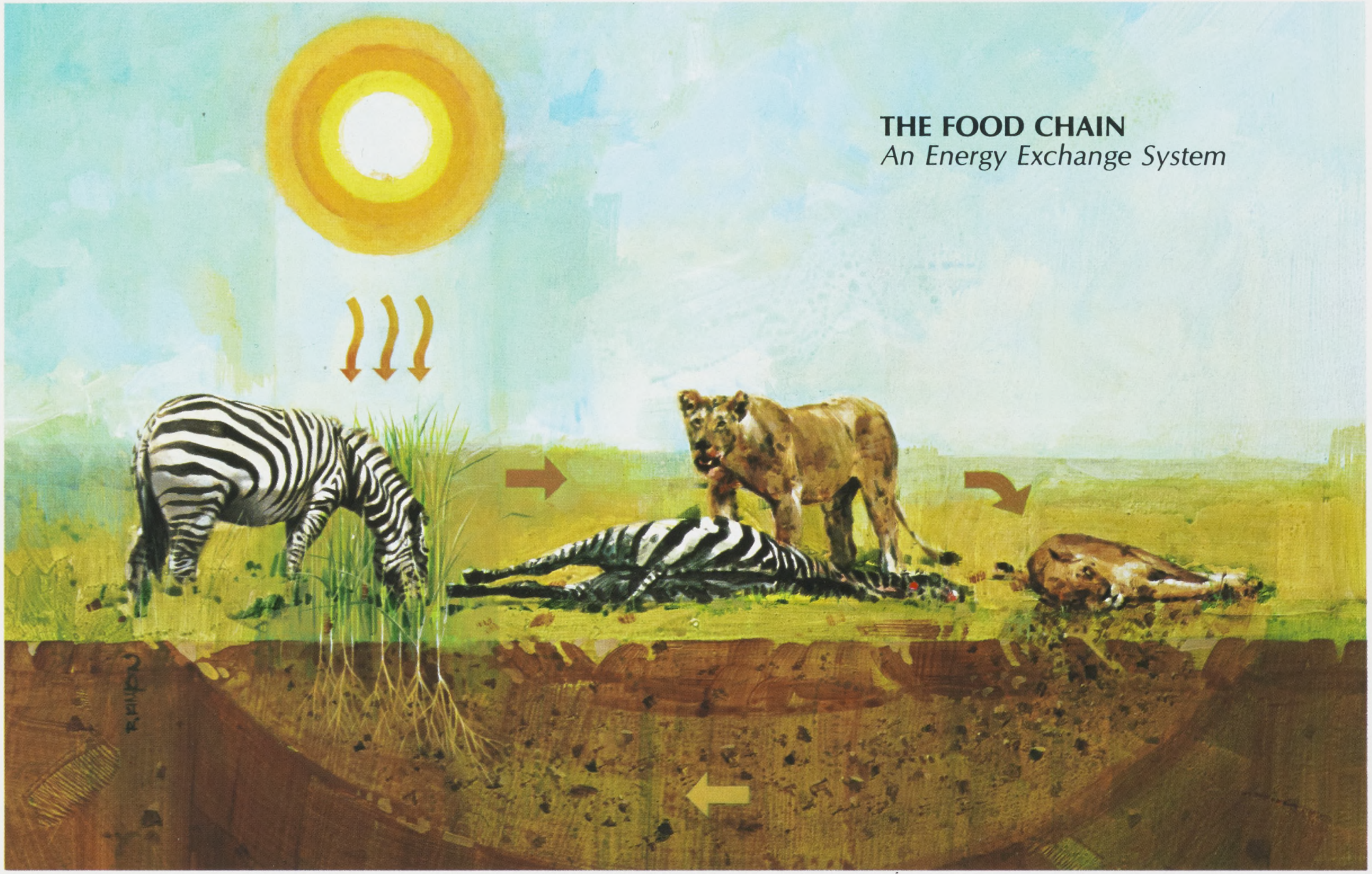
Both the plants and the pollinators benefit from this cooperation. A spectacular example of cooperation among plants is found in certain algae and fungi. The algae use sunlight to convert carbon dioxide and water into the starches and sugars needed as food, and the fungi break down minerals into usable forms. The two plants live together, forming lichen, a botanical community that couldn't exist without both of them. Cooperation in nature is so common that Darwin wrote, "In numberless animal societies, the struggle between separate individuals for the means of existence disappears; struggle is replaced by cooperation." Finally, organisms can live together on a neutral basis. They neither compete nor cooperate. Thus, several species of grazing animals can use the same biome because they live in slightly different ecological niches. One species eats only young grass; another prefers old, dry grass; still another eats the tops; and another takes the lower stems. Several species of birds can live together because their ecological niches are different, perhaps only slightly so, but still different. For instance, a feeding station in an Oregon farmyard will attract rufous-sided towhees, juncos and black-capped chickadees. The towhees cling to the edge of the station; the juncos hop onto the platform; and the chickadees pick up the seeds which fall to the ground.

Competition, cooperation, neutrality. These words merely *define* the relationships which exist between organisms. They do little to describe the subtle ways in which these relationships act as living, dynamic threads in the fabric of life. Neither do they speak of the importance of the relationships and what can happen if one is damaged or destroyed. The moral of ecology is that we must move cautiously in our disturbance of a biotic community and its biome. Ignorant meddling can have long-term effects that we know nothing about. They could be serious, even a matter of species' life or death.

Lichen. This "primitive" plant has a worldwide distribution in warmer, more arid areas where it grows on the shaded sides of boulders. It is actually a community of two plants, fungi and algae.

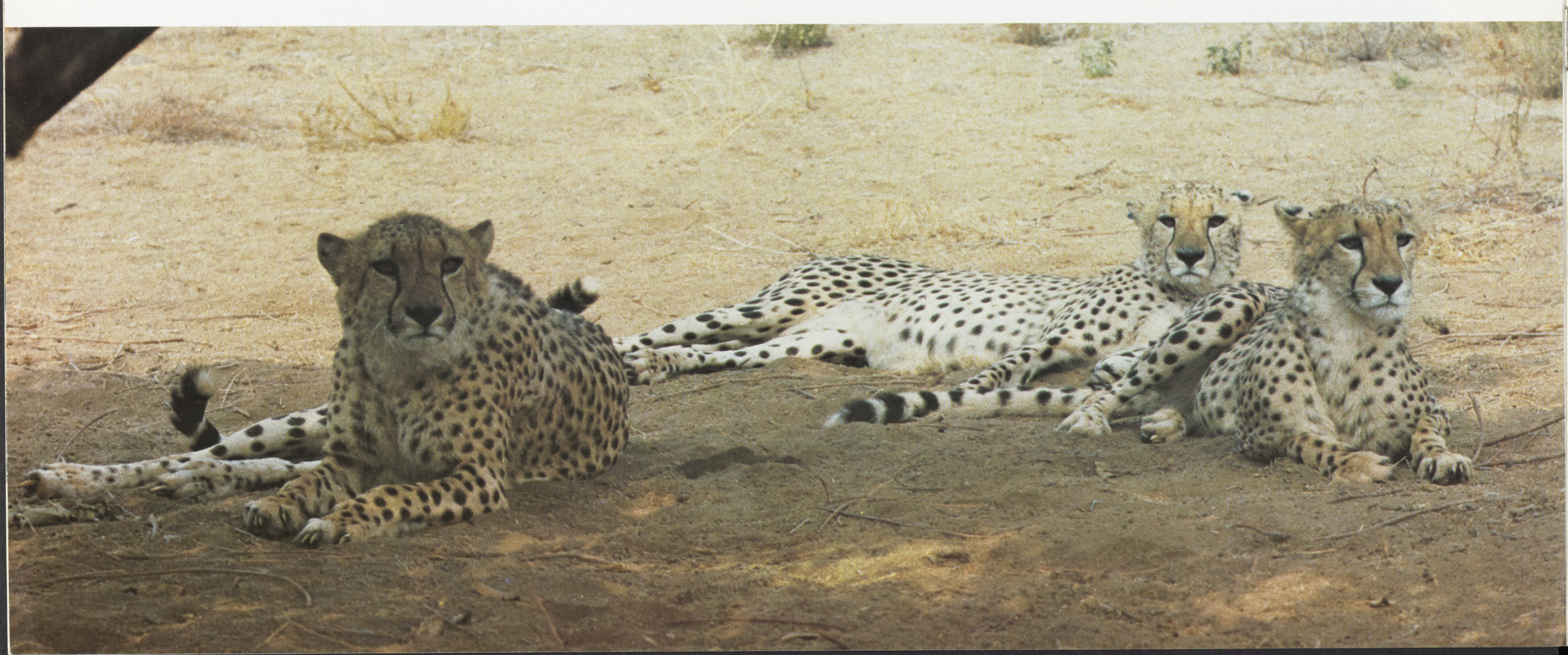
THE FOOD CHAIN
An Energy Exchange System

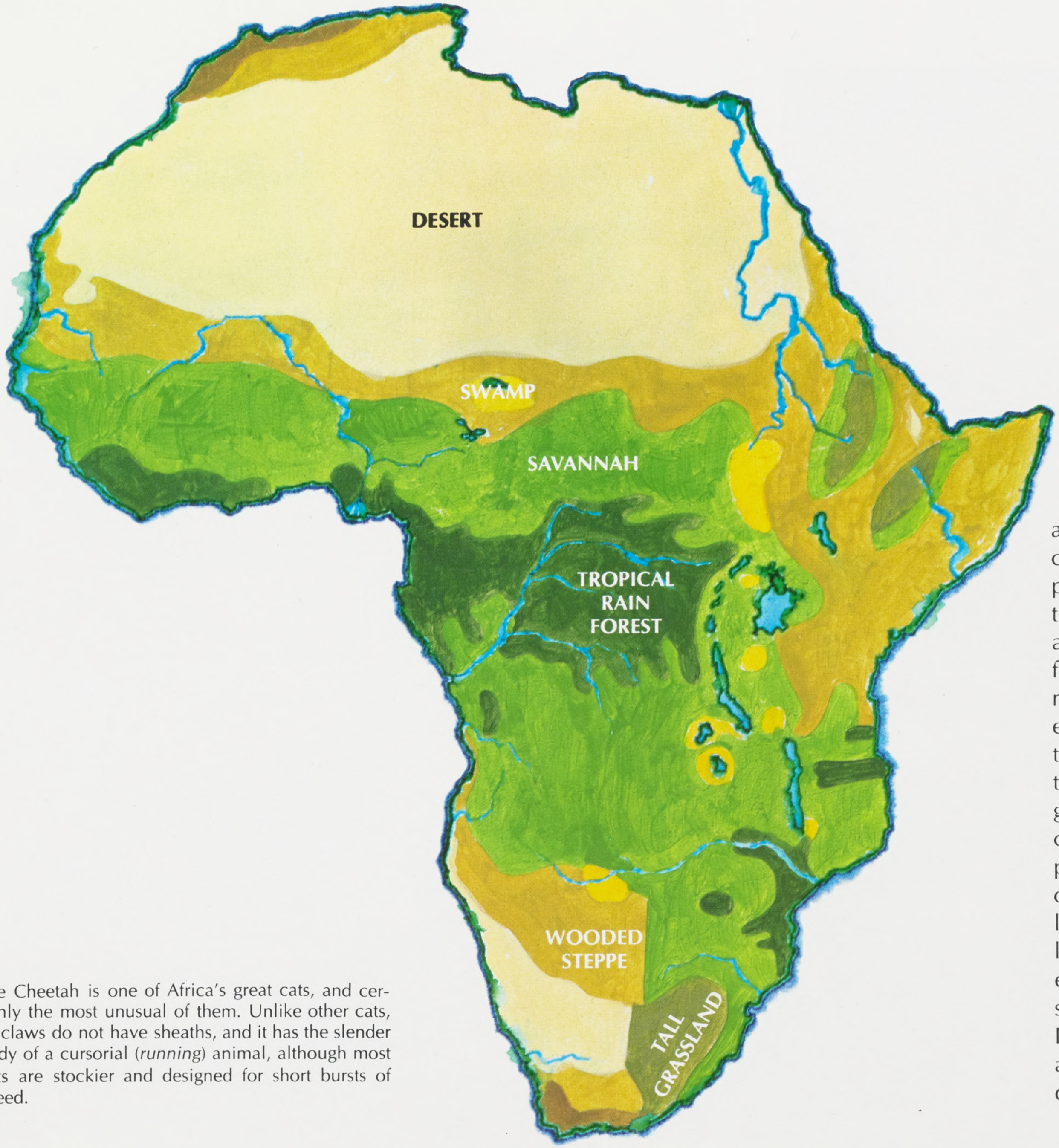


Every animal in the world, from the smallest micro-organism to the most massive mammal, eats some other form of life, animal or vegetable. The sequence of events—who eats whom—is called a food chain. There are countless food chains. A very simple one is illustrated here. Most life as we know it, depends on energy from the sun for its food, for it is this energy which green plants use to convert inorganic material into organic sugars and starches. The process is called photosynthesis and only plants are able to transform inorganic material into organic compounds. Thus, plants, and the sun, are the basic links in a food chain. An herbiverous animal (one that eats vegetation) consumes the plants, and in this way, takes in some of the sun's energy. A portion of the original energy from the sun is passed on to a carnivore (meat eater) when it kills and eats the herbivore. If this carnivore is a large animal such as a lion or man, who is not preyed on by still another animal, it is called an ultimate consumer. It apparently is the end of the food chain. But not quite. When even an ultimate consumer dies, some of the sun's original energy is released back into the earth as bacteria reduce the body to its basic chemicals. These percolate through the soil and are used by plants to aid their growth. Thus, the food chain is seen to be an unbroken series of links, a circle, which takes on energy during the photosynthesis portion of the cycle. This replaces energy lost as heat at succeeding stages.

Africa

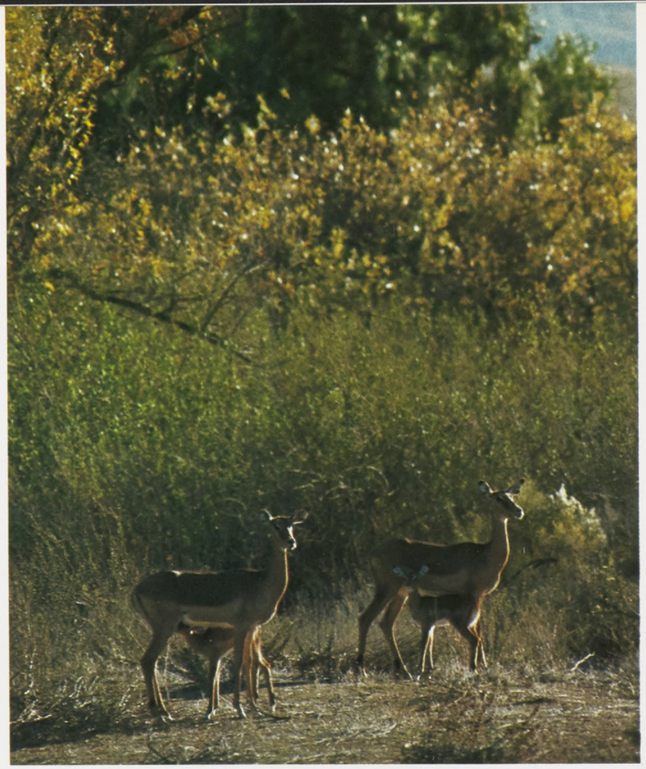
Africa is the last place where wild animals can be seen in large numbers. Geologically, it is a very ancient land, a great plateau which has stayed more or less the same for the past six hundred million years. Under these stable conditions, life in Africa has evolved to fit into countless ecological niches and perfected its adaption to them. Thousands of species have appeared, developed, and worn out their evolutionary welcome. For even in Africa, geologically stable as it is, the physical environment changes, slowly to be sure, but it still changes. A drop in the mean temperature of one degree or so forces great adaptive changes on plant and animal. Those who were overspecialized, disappeared. Throughout the world, far more species have slipped into oblivion than are now alive. Nature is





The Cheetah is one of Africa's great cats, and certainly the most unusual of them. Unlike other cats, its claws do not have sheaths, and it has the slender body of a cursorial (*running*) animal, although most cats are stockier and designed for short bursts of speed.

Impala fawns nursing.



an exacting teacher who doesn't look kindly on mistakes, and overspecialization is a mistake. Those species who survived present a dramatic picture of just how complex ecological relationships are. Nowhere is this seen better than in Africa. Many people assume that all of Africa's animals live in the jungle, and it certainly is true that the jungle—or rain forest, as it is properly called—supports a wide variety of wildlife. But the majority of animals—the game herds, giraffes, rhinoceros, hippos, leopards, even the so-called "King of the Jungle," the lion—do not, and cannot live there. The rain forest simply couldn't support them. These animals live on the open plains, the savannahs. The savannah is grassland with a light growth of trees. It is the dominant biome of Africa. There are others, of course—tropical rain forest and desert to name just two—and each supports its own kind of animals. But only on the savannah with its sunshine, open spaces and grass can one find the game herds and the animals which live among them. The basic commodity which makes such a wealth of life possible is the savannah's grass. This is a community of different plants, each of which has evolved to fit one of the many ecological niches on the savannah. The savannah is a place of relatively poor soil and little rain. During the dry season, of which there are two per year, the plants die back and are eaten down to the roots. Huge numbers of animals—wild and domestic—feed on the grass and tramp it into the ground. Fires periodically

The giraffe, *left*, is the tallest animal in the world. It can grow to eighteen feet, although the average height is much shorter. Giraffes have extremely keen vision, and this, coupled with their height, makes them difficult to surprise. They live throughout East and southern Africa and are associated with growths of acacia, the leaves of which provide their favorite food. *Right*, Waterbuck prodding a White Rhinoceros. Despite the rhino's size, it is a gentle, passive animal most of the time.

race across the plains. Some are caused by lightning; most are set by native herdsmen to keep down the bushes and stimulate the growth of still more grass. Grasses unable to withstand such a combination of pressures long since disappeared. Those which remain provide a rich source of nutrition for the savannah's animals. Just as the presence of these animals have helped to determine the kinds of grasses which grow on the savannah, so the plants have exerted an influence on the animals. Teeth are a case in point. What an animal eats determines the kinds of teeth it will have. If grass is the basic food, the teeth must harvest it, then grind it into a form which can be swallowed. So it is not surprising to find the savannah's grazers with well developed incisors for cutting the grass, and large, flat molars for grinding it. Some species, such as the zebras, have incisors on both the upper and lower jaws. Others, certain antelope and sheep for instance, have lower incisors only. The grinding surfaces on the molars of many herbivores—vegetation eaters—is made up of alternately hard and soft vertically oriented layers. The softer material wears away first, providing ridges which make the grinding process more efficient. Predatory mammals—those which eat meat—have large, sharp canine teeth—the so-called eye teeth—for stabbing weapons that hold and kill prey. To tear the meat apart, the predators have cusped molars. Incisors on these animals are relatively small compared with those on herbivores. Among carnivorous lizards, the teeth are recurved, that is, they point back in the mouth, toward the lizard's throat. As the animal takes bites from its victim, the meat is forced by the teeth farther into the lizard's mouth. Most herbivorous lizards, such as iguanas have no such fearsome array of teeth. They crush plants between their jaws. Interestingly, man and some of the other primates who are omnivorous, that is, who eat both vegetation and meat, have teeth which reflect this all-around diet. They are compromises, neither the large incisors, massive flat molars of the true herbivores, nor the small incisors, large canines of the carnivores.

Uganda Kob *left.* One of the more than sixty species of African antelope, these animals live in East Africa where they are found near water. Only the males have horns. Impala *right.* One of the most attractive and best known of African antelope. They are famous for their incredible ability to jump—often spanning thirty feet and reaching over ten feet off the ground.

The Savannah—Who Lives There?

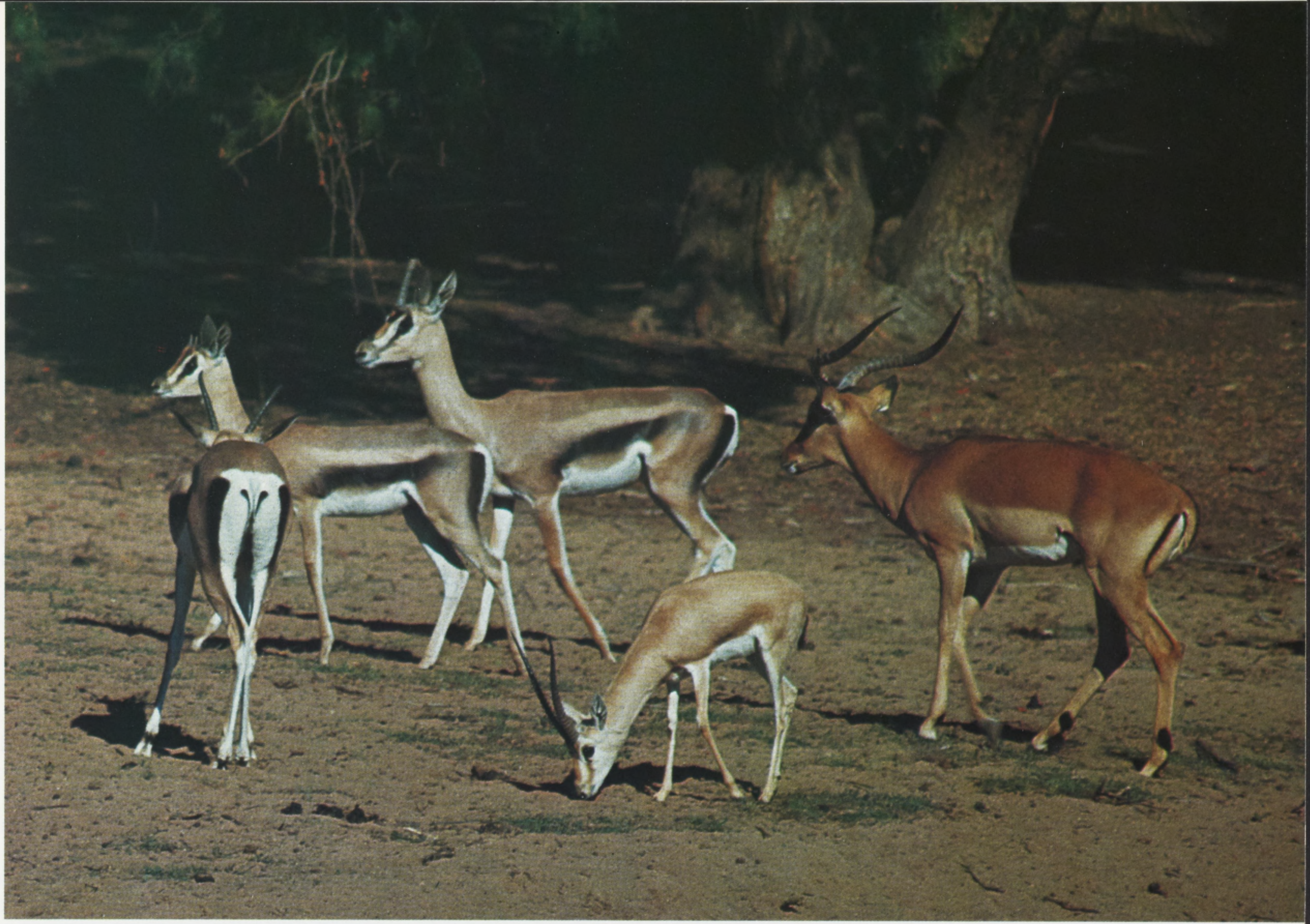
Of all savannah animals, the antelope are most numerous and diverse. They are the basic herbivores, and each savannah or grassland biome around the world has a comparable type of animal. In Eurasia and America, deer fill the same niches. In Australia, kangaroos are the "antelope."

African antelope range in size from the one-foot-tall Zanzibar antelope which weighs less than five pounds, to the 1,500 pound eland which stands six feet at the shoulders. On some species of antelope, such as the sable, oryx, addax, topi and gnu both sexes have horns. On others, such as the impala, lechwe and klipspringer, horns are worn only by males.

Most antelope are creatures of the open savannah where food is plentiful and predators can be seen. For the most part, they live in herds or small harem groups. The most numerous African antelope are the white-bearded gnus, also called the wildebeest.

Some antelope live in biomes other than the savannah. One of these is the lechwe, a creature of the swamps. The lechwe feeds on aquatic plants and grasses. It is fond of swimming and wading and it travels through the water in a series of water throwing leaps. As an adaptation to its wet habitat, the lechwe's hooves are elongated to supply support on the mud.

At the opposite extreme in habitat choice is the tiny klipspringer, a fifteen to twenty-three inch tall antelope who lives on the dry, rocky hillsides of the savannah's watercourses. The klipspringer has a coat of coarse fur which protects its body from bumps and scrapes on rocks. Its hooves are pointed, and the animal is so sure-footed that it



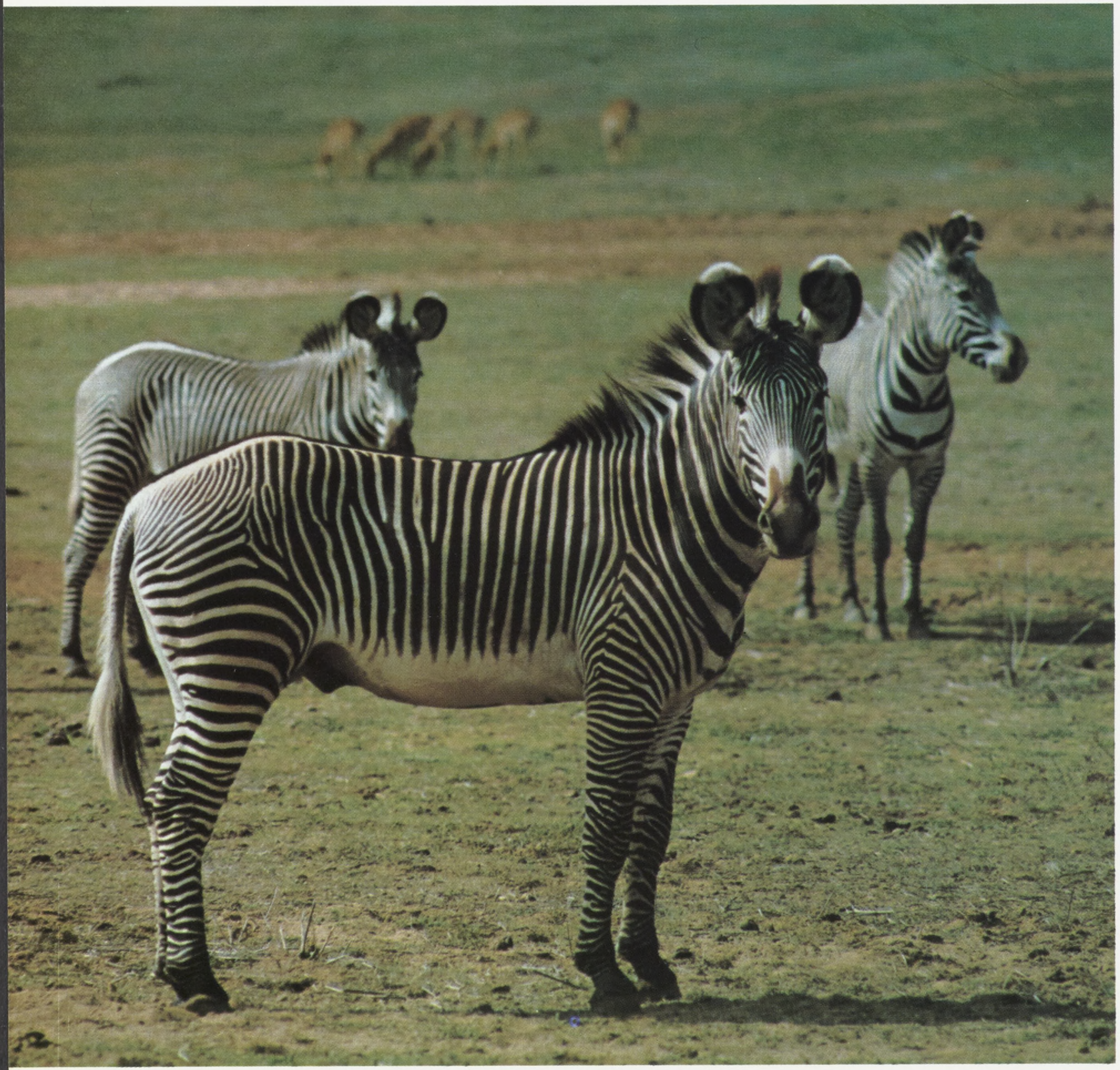
Opposite, The Greater Kudu. A fully grown Greater Kudu can weigh 600 pounds and stand more than four feet at the shoulders. This makes the species second only to the Eland as the largest African antelope. In the photo on this page Roosevelt's Gazelle, *left*, Slender-horned Gazelle, *center*, Impala, *right*. Gazelles are members of the antelope group of mammals. They are noted for their grace and beauty. Roosevelt's Gazelle is identified by the dark stripe along each flank and the white patch on rump and belly. It is a savannah animal of East Africa. The Slender-horned Gazelle is a desert dweller of north Africa. It stands two feet tall at the shoulders and weighs just sixty pounds. The male Impala wears what many people consider the most beautiful horns of any antelope—large, graceful and lyre-shaped.

can land on a rocky projection no larger than a silver dollar with all four feet at once.

Among the most beautiful of all African antelope are the gazelles. These are medium-sized animals with delicate horns and long, slender legs. Gazelles are noted for their speed and delicacy. Brought alert by danger the gazelles bound away seeming to barely touch the ground. One species, the impala, makes leaps thirty feet long and more than ten feet high. Thomson's and Grant's gazelles and the springboks of South Africa can bound along at fifty miles an hour.

There are more than sixty different types of antelope living on or near the savannah. Each has adapted to the unique aspects of its habitat. Some are grazers, that is, they eat grass and little else. Among them are species which eat the tender tips of the new growth; others prefer the full, mature stalks of the grass. Some antelope are browsers who eat leaves, buds and young twigs from the trees and bushes. One of the browsing species, the gerenuk, has a long thin neck and legs. By standing on its hind legs, the gerenuk is able to stretch high into the bushes and low trees for its food. During the dry seasons when the grass has been eaten to the ground, many of the antelope which normally graze, become browsers to keep from starving.

Antelope belong to the group known as Bovines which also includes cattle, sheep and goats. One of the most impressive of the African Bovines is the Cape or black buffalo. A fully-grown bull buffalo might weigh almost one ton and stand five feet tall at the shoulders. He can have a forty-inch-wide spread of horns. Buffalo have a somewhat undeserved reputation for aggressiveness and ferocity. This usually is peculiar to solitary old bulls. Normally, buffalo



Grevy's Zebra. There are no two zebras of any species with identical stripe patterning. Thus the stripes can be said to act as fingerprints as identification for individual zebras.

are shy, retiring and harmless in their herds.

Living among the herds of grazers on the savannah is the world's tallest animal, the giraffe. A giraffe can be eighteen feet tall and weigh more than one thousand pounds. It is a browser and feeds by stripping away acacia foliage with its long, prehensile tongue. Its neck, which accounts for almost one-half the giraffe's total height, has only seven neck vertebrae, the same as most other mammals. The neck's blood vessels have special valves and there is a spongelike network of capillaries at the base of the head to maintain the correct blood pressure in the brain, even when the giraffe leans over to drink water. Giraffes have very keen eyesight which combined with their height, makes them superb sentinels for other herbivorous animals. As other savannah herbivores, their first impulse is to run from danger, but they can be formidable fighters. Many a lion has had its side caved in by the kick of a giraffe.

The wild horse is represented in Africa by zebras. Grevy's zebra is found in east Africa. Burchell's zebra, the most common type, lives in both East and South Africa. The third species, the Cape Mountain, is found in South Africa. Less than one hundred years ago, there was a fourth species, the quagga, which lost its battle for survival to the guns of white immigrants.

Burchell's zebra has broad stripes which pass completely around its body. Grevy's zebra has narrower, more distinct striping and the belly is unmarked. The Cape Mountain species also has a plain belly, and broad stripes on the rest of its body.

These are the main mammals of

Top, Male Black, or Hook-lipped, Rhino. The Secretary Bird, *lower left,* is a relative of eagles and hawks, and is found throughout much of East and South Africa. The Fringe-Eared Oryx, *lower right,* is commonly found in East Africa.

Grant's Zebra, *upper,* of East Africa, and Hartmann's Mountain Zebra, *lower left,* of South Africa, represent two of the three living species. The Eland, *lower right,* of central and southern Africa, is the largest of all antelopes. An adult bull can weigh almost one ton and stand upwards of six feet at the shoulders.

the savannah game herds—antelope, giraffe and zebra. In addition, the ostrich, largest bird on earth, often is seen in their company. An adult, male ostrich can weigh three hundred pounds and stand eight feet tall. The game herd comprises a biotic community. There is little competition for food since each species fills a slightly different ecological niche than its neighbors. For instance, wildebeests eat red oats until the plant is about four inches tall. The zebras prefer the oats when they are mature. Topis, another species of antelope, eat the plant when it is dry. So this one plant, the red oat, feeds at least three species. There are twenty to thirty species of natural grazers and browsers on the savannah and the population of each can number into the thousands. This might seem an overly heavy burden for the grassland but Africa's savannah is capable of supporting a greater population of grazing animals than any other comparable region on earth. It also supports several species of fellow travellers—the carnivores. The best known is the lion. Lions hunt by night and spend the day sleeping in the shade of a thorn or baobab tree. They live in family groups, called prides. Hunting seems to be done primarily by females, but it is the male who gets first chance at the kill, if he is awake at the time. As most predators whose meals come only when they make a kill, lions tend to gorge when they have food. Their favorite prey are zebras and wildebeest. Another cat which preys on the game herds is the leopard. This carnivore has the largest range of any cat in the world—from the tip of south Africa, northward into Siberia. In Africa, leopards kill small antelope and baboons and through hunting help native farmers. One of their favorite foods, baboon, destroys gardens. But today, spotted cats, of which the leopard is one species, are valued by the fashion industry for fur coats. Leopards are poached by the very natives they help. Consequently, the baboon population is rising and gardens are being raided more frequently. The last of Africa's great cats is the

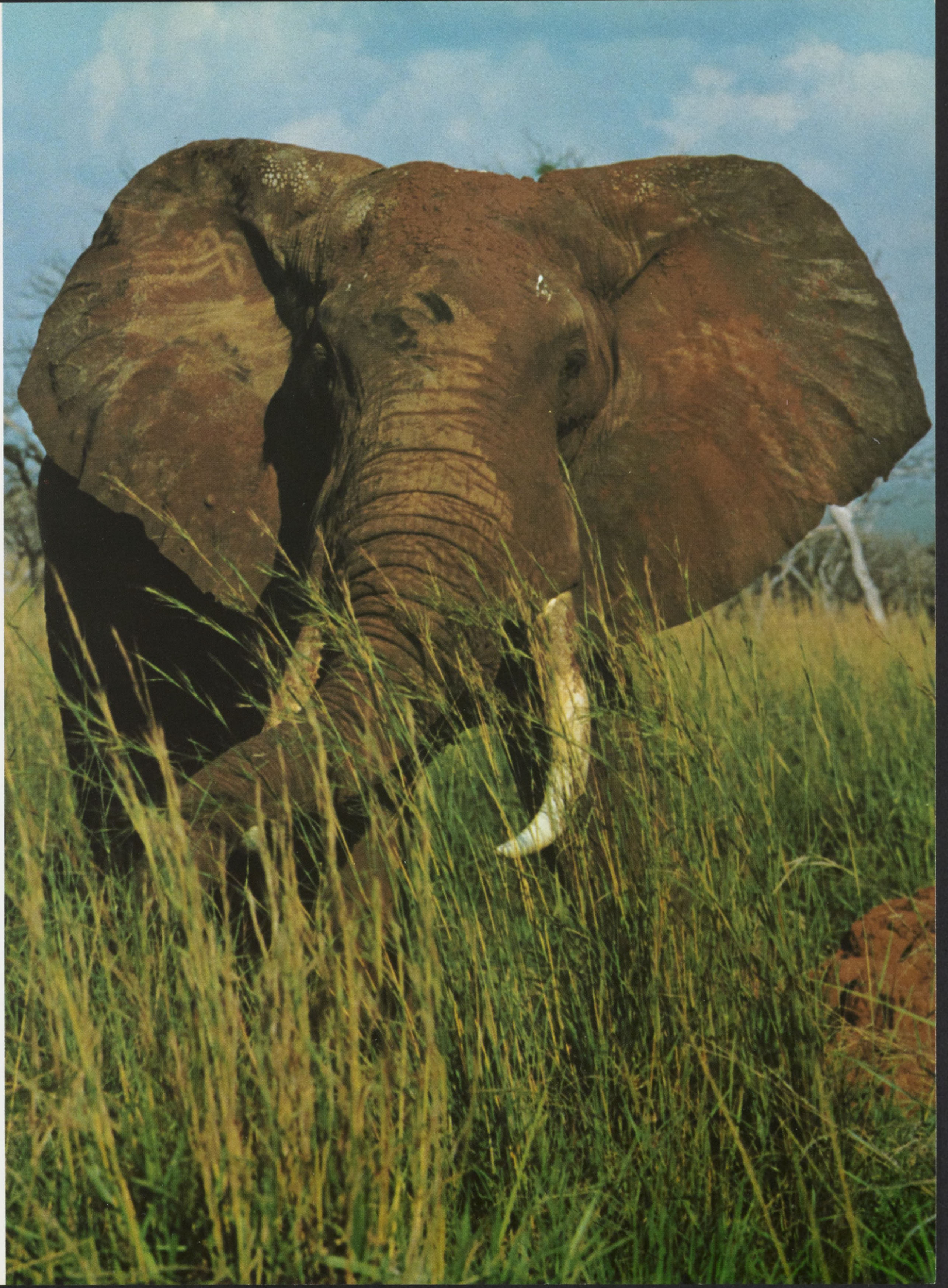
The lion, so-called "King of the Jungle," actually lives on the savannah among the game herd animals, his prey. Lions were thought to migrate with the herds but a recent study showed that only a small percentage of them wander. The majority establish and defend territories that range in size from eight to 150 square miles.

Opposite, Ellipsen Waterbuck. This South African antelope stays close to water as its name implies. The species carries a distinguishing circular ring of white hair on the rump. The Marabou Stork of East Africa is one of nature's scavengers. Although its eating habits and diet might seem somewhat less than appetizing to humans, it, as other scavengers, plays an important role in maintaining an ecological balance. By eating carcasses it keeps down the diseases that might otherwise ravage the game herds. Cheetahs, on the other hand, play out their role in nature as hunters, the predators which account for some of the dead bodies which the scavengers dispose of. At one time, cheetahs were kept by royalty in Africa and Asia as hunting animals. Today, they have disappeared from most of the eastern sections of their range.

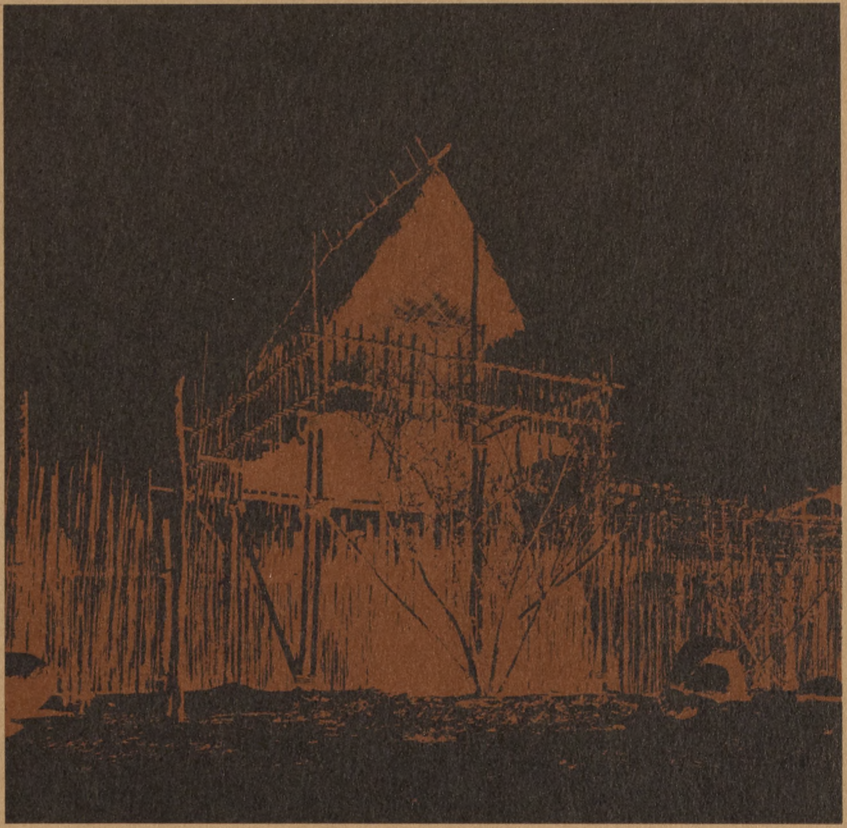
cheetah. At one time, cheetahs were found throughout eastern and southern Africa and well into Asia. Today, the Asian population is extinct excepting a small group in Iran. Cheetahs have long, lean bodies similar to that of a greyhound; their heads are relatively small and rounded, and their legs are long and slender. Unlike other cats, cheetahs cannot retract their claws. Cheetahs are the fastest land animal in the world, with sprints of seventy miles an hour being recorded. In addition to the great cats, the savannah is home to several species of small cats, all of whom are predators. One of the most beautiful is the caracal, a member of the lynx group. The savannah has non-cat predators also. One of the most respected is the African hunting dog. This black and white, bat-eared member of the Canid family fills the same ecological niche which wolves do in Eurasia and North America. In Australia in former times, the Tasmanian wolf played a similar role. Hunting dogs live in small family groups. They are solicitous of each other and very loving of their puppies. Like wolves, they hunt in packs. Jackals live on the savannah but are not hunters in the sense that the hunting dogs are. They tend to be more scavengers, eating the kills which other predators have brought down. As scavengers, the jackals must compete with other animals of nature's garbage men group. These include hyenas and at least two birds—vultures and maribou storks. A kill on the savannah attracts several scavengers—vultures wheeling overhead or squabbling for food, storks darting in to rip away meat, and waiting at the perimeter of activity, the jackals. Then at night, the hyenas come, heavy-shouldered and massive jawed, to break up the last of the carcass, bones and all. Hy-

The Topi belongs to a group of antelope which is found only in Africa. They live along the coast in East Africa, in open savannah and woodland. The African Elephant, *opposite*, is the world's largest land animal. It can grow to weigh eight tons. Such an enormous weight requires a massive bone structure to support it. Understandably, an African Elephant's skeleton can account for up to 15 percent of the animal's total weight.
Next page, Nairobi Village.

enas have the most powerful jaws for their size of any mammal. This is an adaptation to fit them into their ecological niche—bone eaters. But contrary to what has been believed for many years, hyenas also do some of their own hunting. Nothing edible lasts long on the savannah, for this wilderness, as all wildernesses, is a place of hunger. Where there is food, there is always something to eat it. First, the predator, then the scavengers. The insects are next—ants, beetles, wasps and countless others—who suck the juices away. Finally the bacteria reduce what is left of the soft tissue back to basic chemical ingredients. And if this little drama is played out in a humid area, the bones themselves dissolve into the earth. No discussion of the savannah biome would be complete without mentioning some of the non-game herd species. One of them is the largest animal on earth, the elephant. As recently as the latest ice age, just a few thousand years ago, elephant-like animals roamed most of the northern hemisphere. Some, such as the hairy mammoth, were heavily furred to withstand the cold. Others, such as the mastadon, were much larger than today's elephants. Then suddenly, in evolutionary terms, all but two species, one African, the other Asian, disappeared. Of them, the African is the larger. African elephants live in almost every part of the continent excepting the deserts—rain forests, at sea level and up to twelve-thousand-foot elevations. But they thrive best along the forest/savannah edges, a transition zone between one biome and another that is known as an ecotone. Elephants are browsers and use their trunks to strip away leaves and branches. If they can't reach the food they want, they are quite capable of pushing



Nairobi Village



Guide Map

1 ENTRY RONDAVEL
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5 RESERVED FOR ECOLOGY CENTER
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8 PARK ADMINISTRATION
Information, Security,
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9 WGASA BUSH LINE
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10 SPIDER MONKEY EXHIBIT
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19 BLACK RHINOCEROS EXHIBIT
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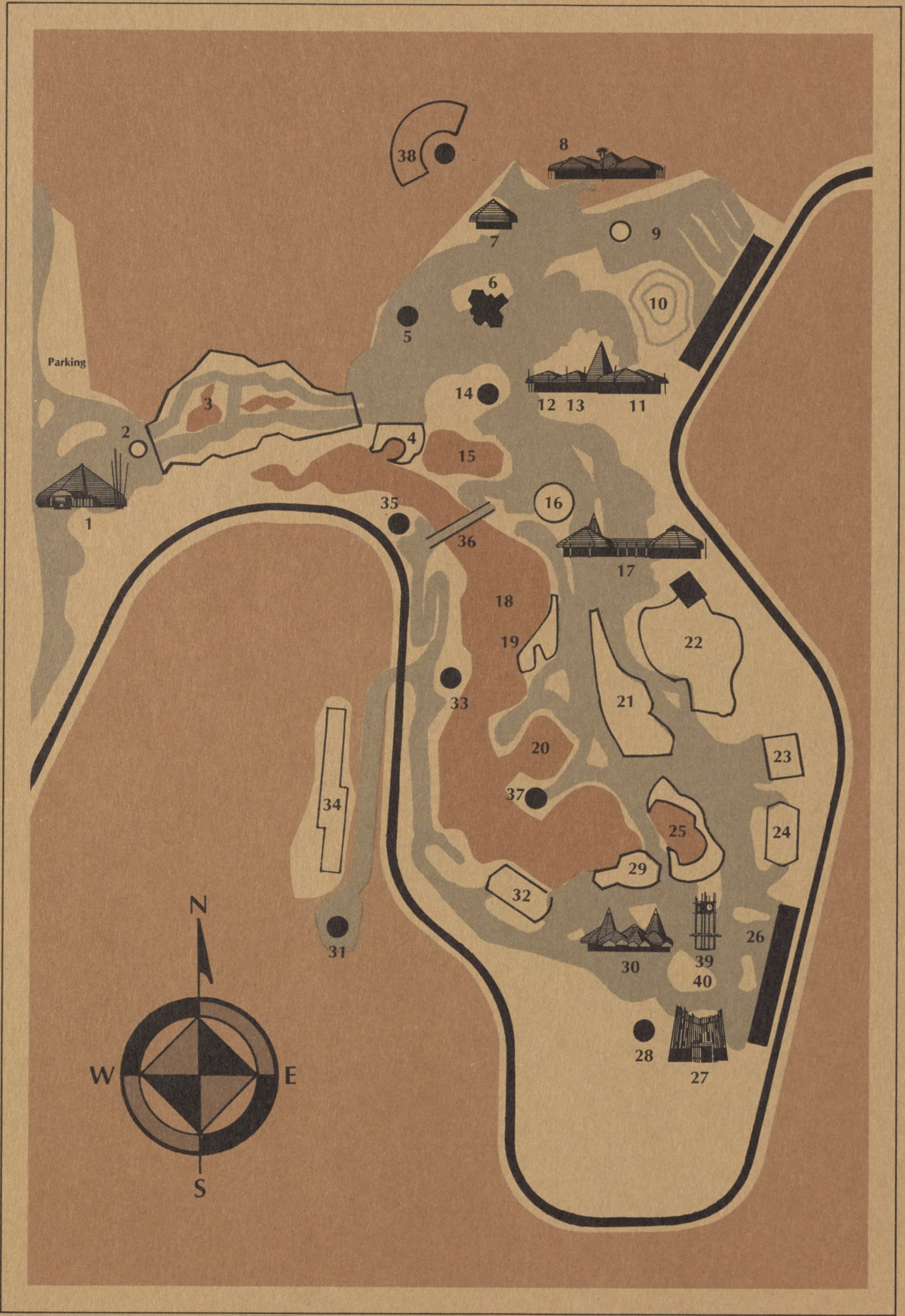

Nairobi Village is "Port of Entry" for the San Diego Wild Animal Park. It occupies about seventeen of the Park's 1800 acres and is a complex that includes shops, the Park's administrative headquarters, animal exhibits, special attractions and the embarkation and debarkation points for the monorail, the Wgasa Bush Line. The Village was initially designed in a style reminiscent of East African architecture. Here in Nairobi, California you will find places to eat, to shop, to view more distant animals or just loaf. Among the points of interest in the Village, the following seem to hold special appeal for visitors:

WGASA BUSH LINE

9. Simba Station, Embarkation Point. 26. Terminus, Debarkation Point. A trip on the Wgasa Bush Line is one of the high points of a visit to the Park. Occupying the better part of an hour, the trip is a five-mile "safari" through Eastern, Northern and Southern Africa, Asian Swamps and Plains, riding along in silent, electric monorail cars. Visitors pass a large pride of African lions, lounging in a canyon enclosure, and African and Asian elephants each in their own large compounds. The major animal enclosures—averaging one hundred acres or more in size—enable the animals to live almost free, as they would in their homelands. Parts of the high veldt in Eastern Africa are much like the Park site, and people who have visited Africa say that there is just one main difference in animal viewing—they can see far better more species at the Park than in Africa and obviously in a shorter time. Each of the Bush Line trains is operated by an experienced guide who points out the animals as the train moves along. Frequent stops are made for better viewing and picture taking.

PLACES FOR STROLLING, EATING OR JUST ENJOYING

1. Entry Rondavel. The circular, domed Entry Rondavel at the Park is patterned after a unique African structure—the tomb of a Uganda king. It contains ticket booths, restrooms and an information center. **11. Thorn Tree Terrace.** A cafeteria which has a varied menu for dining on the shaded terrace.

17. Animal Care Center. Many large enclosed stalls, some plate-glass fronted, provide excellent viewing of baby animals. Also, visitors can watch food being prepared for animals housed in the Village and see first aid treatment.

18. Lagoon. This 1,500,000 gallon, man-made body of water contains many exotic water fowl. In winter, it is expected to play host to large numbers of migratory water fowl.

23. Viewpoint. From this vantage point, you can look out on the plains of "Eastern Africa" and observe many species of animals, including Black and northern race White Rhinos.

24. Picnic Area. Another excellent place to watch the animals.

25. Elephant Wash. In their southeastern Asian homelands, work elephants are bathed in rivers daily and scrubbed by the mahouts. Here in the Park, some of the young Asian elephants are bathed in a large lagoon, providing a delightful spectacle, especially for photographers.

30. Mombasa Cooker. A snack bar and dining terrace overlooking the main lagoon.

36. Fishing Camp. On many African rivers, natives build primitive structures to support fish traps. Our camp was created from native materials and built over a man-made 1,200-gallon-a-minute cataract into the lagoon.

39. Clock Tower. If there's any doubt about where to meet friends or members of your family, make it at the clock tower. It can be seen throughout the Village.

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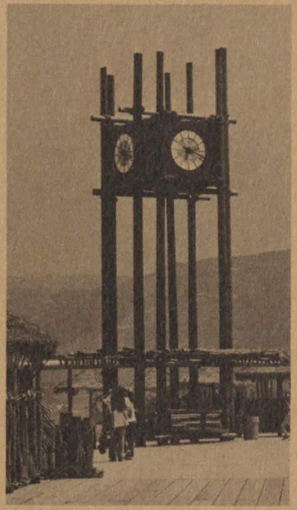
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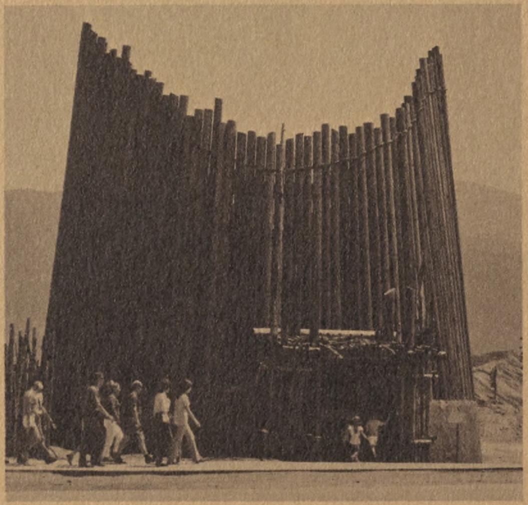

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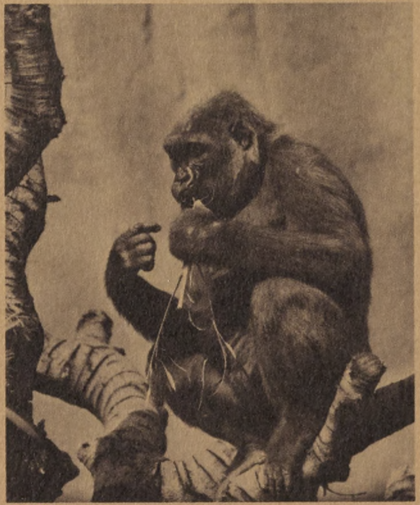

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ANIMAL EXHIBITS

There are several animal species on exhibit in the Village which, because of habits and size, are best seen close up.

3. Aviary. More than 300 birds, representing 32 species, are housed in this enormous, beautifully planted, cable-suspended wire mesh free flight cage.

4. The Lesser Flamingos seen here nest only in the soda lakes of the Great Rift Valley of East Africa.

6. Toucan. These tropical American birds with enormous bills appear out of balance, encumbered with such a beak. But the toucan's bill is a masterpiece of structural engineering, honeycombed to be amazingly lightweight and an efficient fruit-gathering tool. Toucans, of which there are 37 species, range from southern Mexico southward to Paraguay and northern Argentina.

10. Spider Monkey. These agile monkeys are one of the many American species that have prehensile tails. Monkeys from the Old World do not have this extraordinary appendage.

15. Pelican. The pelican's pouch is a dramatic example of adaptation. Through eons of evolutionary development, it has become a "net" in which the pelican traps fish. He holds his prey in the pouch long enough for water to drain away, then with a toss of his head, swallows his catch.

16. The Galapagos Tortoise is the world's longest-lived animal. It is known to live in excess of one hundred years.

19. Black Rhinoceros. There are five species of rhinos still living. Three of them are found in Asia and exist on the very cliff edge of extinction. Of the two African species—the White and Black—the Black has a far larger population and lives in a much larger range.

20. Ring-tailed Lemurs are one of several species of these primates, found only on the island of Madagascar. Lemurs range in size from a tiny, mouse-like creature to an animal the size of a terrier.

22. Kraal. Here, in the intimacy of this contact area, children can experience togetherness with many kinds of animals in a one-to-one relationship.

27. Green Iguanas. This herbivorous lizard from tropical America is quite harmless despite its ferocious appearance. The only damage it might inflict would be a nip or a scratch.

29. Greater Flamingos are the most widely distributed of all flamingo species. They are found in East Africa, along the Mediterranean eastward into India and Ceylon.

31. The Komodo Dragon is the largest of all carnivorous monitors, sometimes measuring eight to ten feet in length and weighing up to three hundred pounds. It is found on three small islands in the Indonesian archipelago. The Dragon, although strongly attracted to decaying carrion, can run down wild pigs or deer if it chooses fresh meat.

34. The Lowland Gorilla has been called a "Gentle Giant." And despite its awesome appearance, this is truly one of nature's gentle creatures. It is a vegetarian and lives in tropical West Africa.

40. Desert Lizards. Animals which live in the hot, arid deserts of the world, have adapted in special ways to withstand their water free environment. For the most part, they require very little water. Many of them, the lizards included, get water from the food they eat. Many desert animals retreat in the heat of day and hole up under a bush, in the crevices of rocks, or in underground burrows. Still others estivate, which is the summer equivalent of winter's hibernation—a slowing of the body process almost to the point of death. The desert lizard, however, is up and about in mid-day, skittering across the sand from the shade of one bush to the safety of an overhanging rock, to a tree, and maybe back to the starting point.

White-bearded Gnus, *preceding page,* are the most plentiful of African antelope. They live in herds from Kenya southward to the very tip of the continent. Thousands can be seen during the seasonal migrations. *Left,* Elephant walk. Hatari, of motion picture fame, leads younger African Bush Elephants at San Diego Wild Animal Park. *Opposite,* Southern Eland. Currently, there is an effort afoot to domesticate elands, the largest of the antelope. The hope is that this animal, which thrives on grasses that cannot support cattle, will help to overcome the protein starvation suffered by many of Africa's native people.

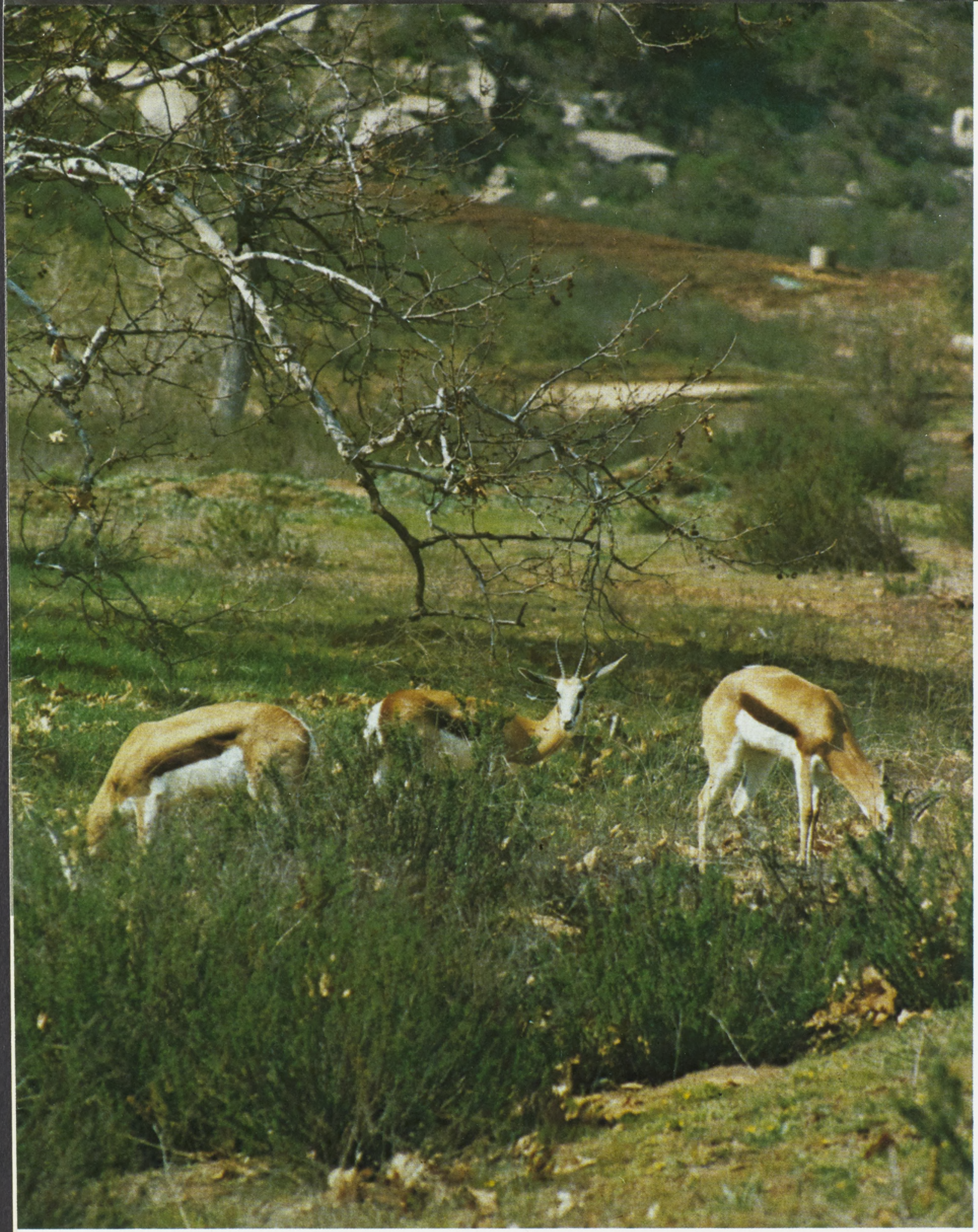
over fairly large trees. Elephants need upwards of 350 pounds each day, so they make dramatic changes in the landscape as they work their way through an area. In the old days, when the savannah was open and populated by only wild animals, elephants actually helped the environment by opening forest land and digging in the earth with their tusks. Now, with the only habitat being protected areas, the elephant population must be controlled or it would overeat its habitat.

Another of the savannah's well-known animals is the rhinoceros. There are two species in Africa, and three in Asia. Of the African species, the white, or square-lipped is the larger, weighing up to four tons. As indicated by the shape of its mouth, the white rhino is a grazer. It is also much more placid than its relative, the hooked-lip or black rhino, Africa's second type. The black rhino is a browser, and is reputed to be a near-sighted, nasty-tempered beast who will charge just about anything, including railroad trains.

Rhinos have been persecuted for centuries by man. Certain parts of their bodies are thought to have medicinal powers. For instance, the horn, is said to be a powerful aphrodisiac. Rhinos have paid a terrible price for this bit of nonsense.

White rhinos almost disappeared. Then the South African government stepped in to protect them. Those living outside of game reserves were transported to safety. Eventually, these semi-captive herds grew large enough to allow a few animals to be sent to zoos and game reserves. The white rhinos at the San Diego Wild Animal Park came from South Africa.

Although



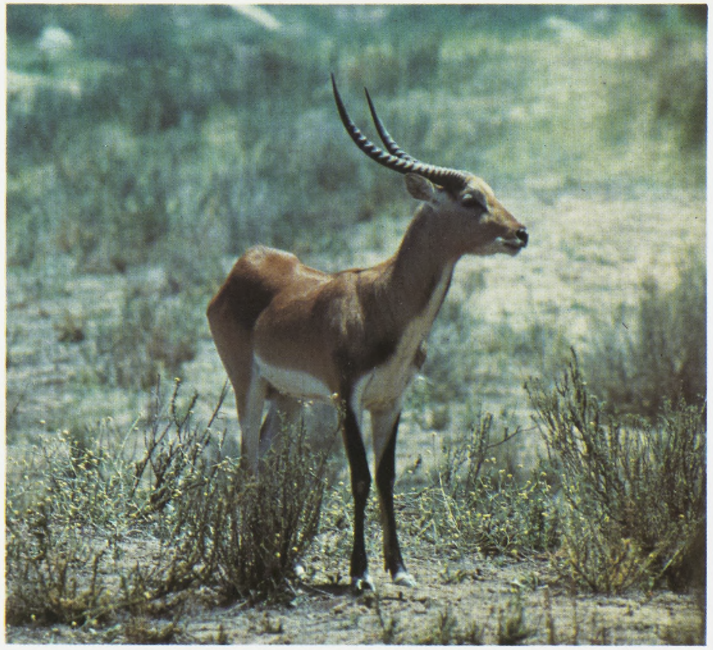
Springbok. This South African antelope once lived in such numbers that *millions* would migrate across the land during droughts. Their numbers proved disastrous to farmers' crops. *Opposite*, Cape Hartebeest. An antelope which lives from Rhodesia southward into South Africa. The Hartebeest is persecuted by hunters who want a fine trophy head. This persecution has reduced the extreme northern and southern forms of the species to the edge of extinction. However, the species seems to be holding its own in the middle of its range.

the hippopotamus is not, strictly speaking, an animal of the savannah, it deserves inclusion as one of the biome's creatures because of its feeding habits. Actually, the ecological niche into which the hippo fits is the sluggish African river or lake shore. At night, hippos wander onto the grassland to graze. If any living thing gets between a hippo and his route back to the water, the normally placid animal can become dangerous and aggressive. The wart hog, a relative of hippos, is found living in small family groups on the savannah. As its name implies, it has wart-like growths beneath the eyes. Its tusks are efficient tools for rooting in the ground after the roots and tubers which make up a large part of its diet. When running at high speed, the wart hog carries its thin tail erect. The main primate on the savannah is the baboon. Baboons travel in large troops on the ground searching for food. As many primates, they eat just about anything edible. As the troop moves, the mature males stay on the flanks to protect the females and infants. Although they feed and travel by day on the ground, at night the baboons retreat into the trees. There are many animals which live on the African savannah, far too many to be mentioned here. Among the birds, there are the ostrichs, tick birds and the weaverbirds who build hanging nests with the opening at the bottom to keep out predators. There is a bird called a honey guide, who eats the wax from bees' hives. But it can't open the hives to get at the wax. So the bird guides other honey loving animals, including man, to the hive. Then after the other animal has taken the bees' honey, the honey guide eats the wax. Among the ground dwelling birds of the savannah, the vulterine guinea fowl seems to fill the same niche as quail do in other areas. And, of course, there are flamingos, whose niche is the heavily mineralized lakes of east Africa. Here, brine shrimp provide food for the birds. There are insects on the

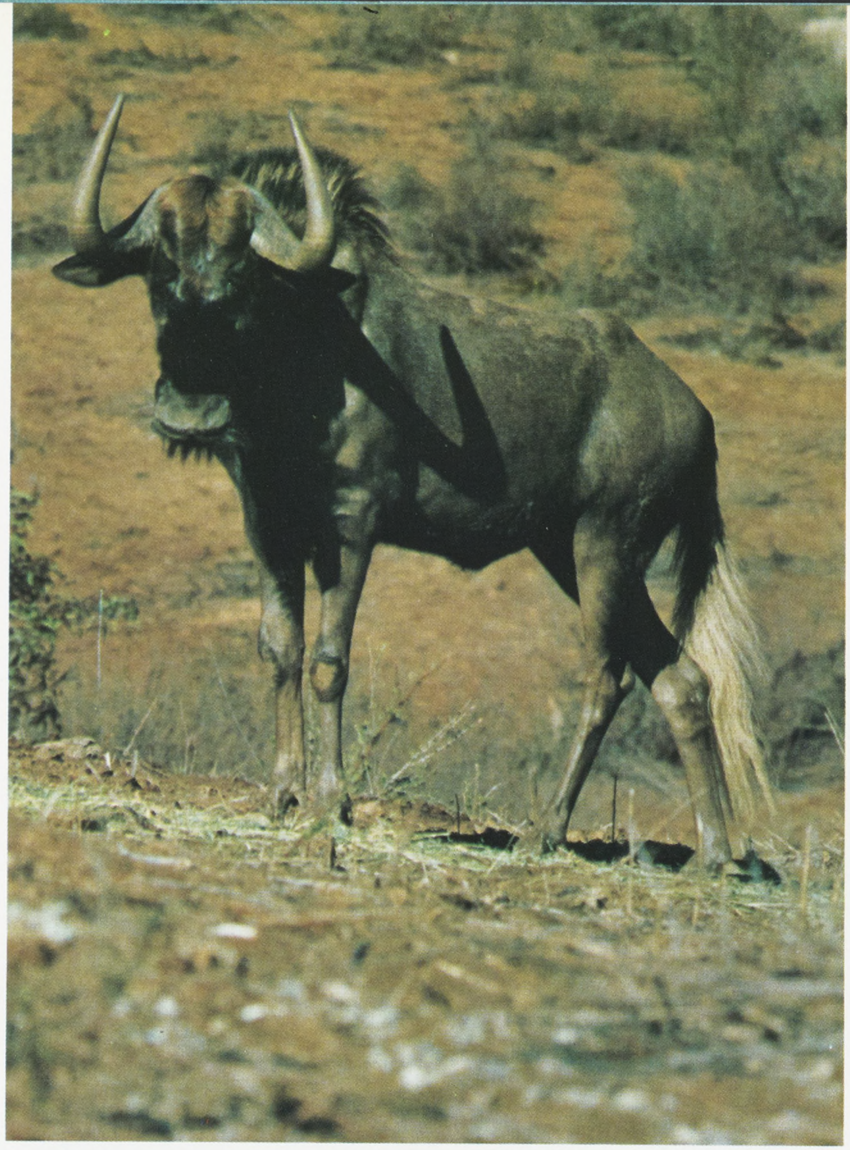
Opposite, The Ostrich—the world's largest bird. When fully grown, a male can weigh 300 pounds. Ostriches have extremely powerful legs and can disembowel a lion who is rash enough to get kicked by one. The Lowland Nyala, *left.* Lives in South Africa. A mature male can weigh 250 pounds and stand about forty inches at the shoulders. The Sitatunga, *right,* is an East African antelope which is found in or near the water. Its hooves have adapted to the swampy areas in which the animal lives. They have become elongated and act as "snowshoes" to support the antelope on the mud.

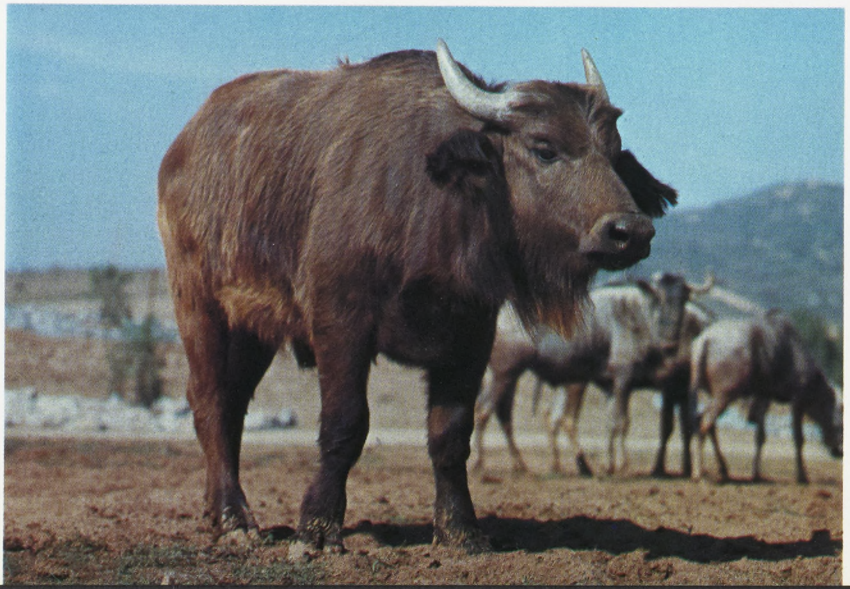
savannah, thousands of species. Some fly, some crawl, some burrow into the earth. Some eat plants; others bite or bore into animals, probing for blood. Many of the savannah's insects are disease carriers, such as the tse tse fly which is an agent for sleeping sickness, and the Anopheles mosquito, carrier of malaria. Savannah reptiles include many poisonous snakes—several species of cobras, the mamba and certain adders. One of the world's largest constrictors lives among the rocks—the rock python. And there are the dangerous crocodiles in the rivers and lakes. There is one snake on the savannah's edge which points up the dangers of overspecialization. It is called the egg-eating snake. It eats eggs and only eggs. It has a lower jaw which can unhinge to allow a full egg to be swallowed, even though the egg is much larger in diameter than the snake. As the egg passes down the snake's throat, a series of sharp bones which project from the neck vertebrae, cut it open. The shell collapses and the fluid runs down the snake's gullet. The shell is spit out. The danger which the egg-eating snake faces is that there might be no eggs during much of the year. Two things keep it from starving. First, during the times when eggs are available, the snake gorges. Secondly, as most reptiles, the snake is able to go for long periods, months if necessary, without eating. But one poor nesting season could kill it. The amount of food for any species on the savannah is tied ultimately to the rainfall. During the wet season the grasses are up and the trees put out new leaves and shoots. The herbivores grow

Impala silhouetted against a Southern California evening sky—San Diego Wild Animal Park. *Below,* Red Lechwe. Another antelope which prefers a wet habitat in which to live. *Opposite,* Red Lechwe, *right,* and two Waterbuck, *left.* These two species are closely related. Waterbucks, despite their name, wander farther away from watercourses than the Lechwes do. They can be found miles from the nearest water.



fat and glossy, and wander very little. Water and forage are plentiful. But during the dry seasons life is hard and the time of hunger comes, just as it does during northern winters. The grass dies back and is eaten to the ground. Water holes dry up. The trees grow dormant and drop their leaves. Browsers eat the last of the twigs and little sprouts, then they turn to eating whatever grass is left. The game herds begin to move, searching for water and food. Thousands of animals move out across the savannah. During prolonged dry seasons, when the rains do not come at all, even larger migrations take place. They are led off by the elephants who dig out watering spots in the bottoms of river beds. Sometimes these droughts last for years, bringing terrible hardships to the wild animals. Tens of thousands of them die, and only the vultures grow fat. But the savannah has known droughts for thousands of years, and bad as they are, life goes on. Unless man upsets the balance, there are always enough animals and plants left to begin again. Why do the animals continue to live where there is such a threat to their existence? It is because they are adapted to the biome of the savannah and to the ecological niches that are uniquely their own. They might suffer from the droughts, but elsewhere, they would perish, for they are creatures of the grasslands. Nature is a harsh provider and exacting taskmaster. But it is the only provider there is.





White-tailed Gnu, *above.* This is one of the rarest members of the antelope group. It is extinct in the wild. At one time, fewer than one hundred still lived, and they existed only because they happened to be fenced inside the farms of people who cared about wildlife. The Cape Buffalo, *below,* of South Africa is a creature greatly respected by hunters. Wounded bulls have been known to stalk and charge humans without provocation. The Slender-horned Gazelle, *opposite,* is another rare species because of man.

Elsewhere on the Continent

There are biomes other than the savannah in Africa. One of the most famous, yet least known, is the tropical rain forest. Centered around the Congo basin, this is an area of approximately one and one-half million square miles. The rain forest is a place of relative stability. Temperatures and the heavy rainfall stay within close limits, month in and month out. Trees provide an extremely dense cover. The only place that direct sunlight reaches the ground is where a tree has fallen. This fact of very thick forestation determines the animal life. There is little ground cover in the rain forest. Few plants can grow in the dense shade. Thus, there are no game herds. There is a wealth of insect life on and under the ground, busily eating the debris of leaves and twigs which rains down from the trees. But most of the larger animals live aloft—birds, reptiles and mammals, all are adapted for the arboreal life. Of these, perhaps the most fascinating to man, are the primates. Primates include the prosimians, monkeys, apes, lemurs and man. They came into existence about sixty million years ago. The first primates were tiny, squirrel-like creatures, much like today's tree shrews, and from that primitive beginning, the primates evolved to their present form. There are many species of monkeys in Africa's rain forest. They, along with the monkeys of the western hemis-

Opposite, Sable antelope. This splendid species has scimitar-shaped horns which can curve back over the shoulders in some males.
The Gemsbok, or South African Oryx, *below,* lives in herds of from 30 to 40 animals that migrate across the land seeking food. Perhaps, the myth about unicorns arose from the oryx. When seen in profile, it could be imagined to have just one horn. *Right,* Waterbuck.

phere, present a fascinating picture of what scientists call parallel evolution. In these two widely separated places and entirely independent of each other, the same animal evolved to fill an ecological niche. New World and Old World monkeys are only distantly related, yet they are remarkably alike. Both live in troops, in trees, and eat approximately the same food. One of the most obvious differences between them is the use of the tail. Many New World species have prehensile tails—that is, they can grasp with it. No Old World monkeys have this ability. Another of the African rain forest primates is the chimpanzee who is said to have intelligence second only to man. Chimpanzees spend part of their time on the ground and travel in large, noisy bands. They eat vegetation, primarily, but have been observed killing and eating small rodents and antelope. Finally, the largest of all primates, the gorilla, is a resident of the rain forest. A mature male gorilla can weigh more than four hundred pounds. For all his size and seemingly ferocious expressions, the gorilla is a timid, retiring creature. One writer has called gorillas, "Gentle Giants." At the opposite extreme from the humid rain forest is the desert biome of Africa. Desert life must adapt to extremes of heat, cold and constant aridity. Some desert animals, such as the camel, store nourishment and can go for extended periods without eating or drinking. Others, such as many of the rodents and at least one antelope, the oryx, probably get all the water they need from their food. Some desert animals adapt by be-

Nyala ewe and Demoiselle Crane. This delicate, gray and black bird is one of the most beautiful of all cranes. It winters in northern Africa, Asia, and India. *Opposite,* Grevy's Zebras.

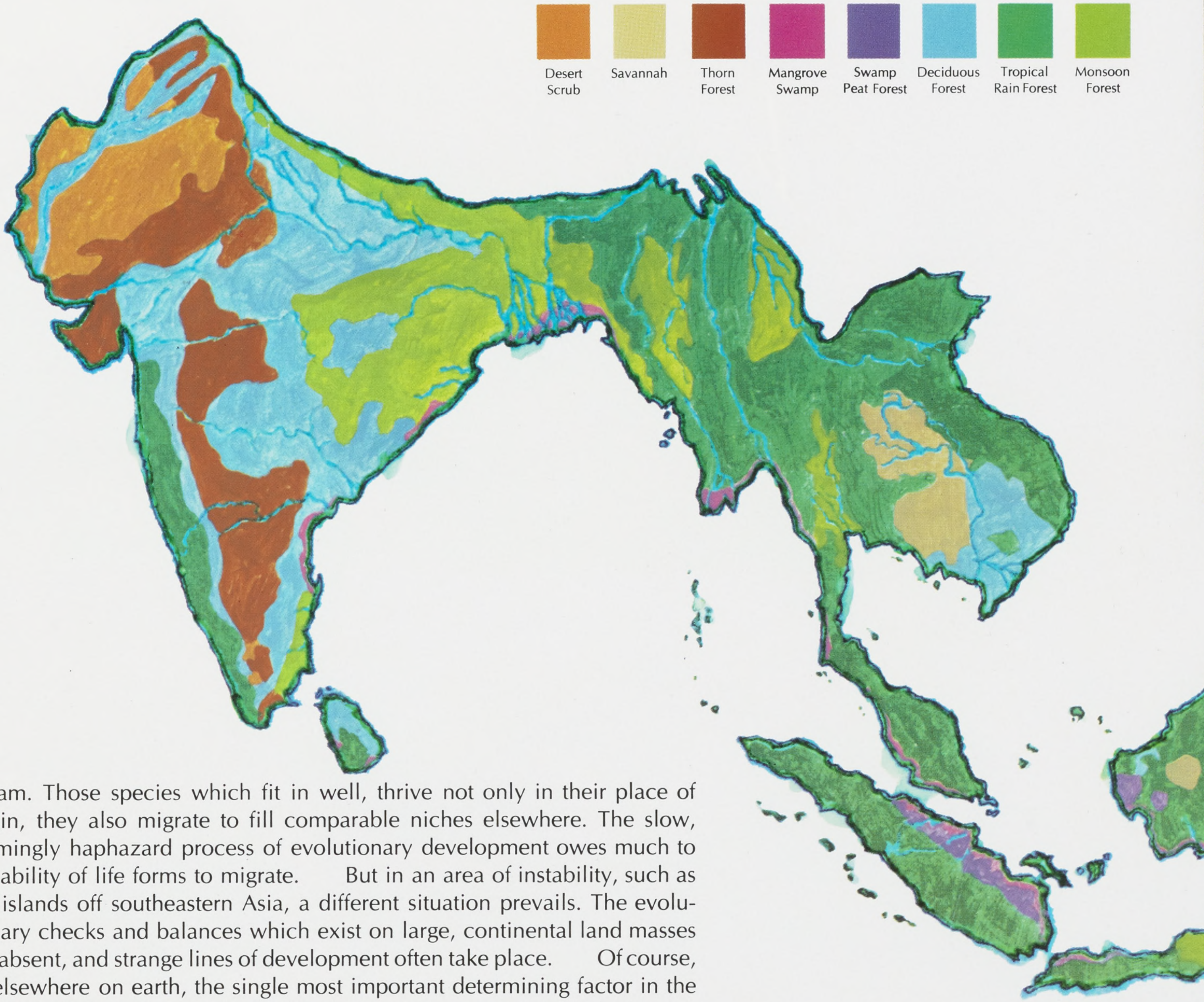
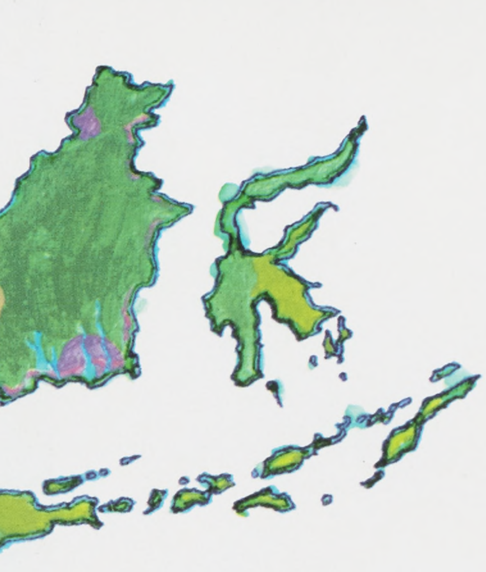
coming omniverous, although the same species in more favorable climates specializes its diet. A case in point is the fennec fox. This is the world's tiniest fox, with what surely must be the largest ears of all for an animal its size. The fennec is a member of the dog family. Normally, dogs eat meat only. Yet the fennec, an inhabitant of the Sahara Desert, will eat just about anything it can get hold of. Because of the harsh conditions, desert animals tend to live singly or in very small groups. The desert antelope—oryx and addax—are found alone or in tiny herds. Desert sheep live in small family groups in the barren hills. There simply isn't enough food to support large concentrations of animals. Many of the desert's plants and animals have adapted to their environment by becoming dormant—estivating—during the hottest, driest times of the year. Estivation is the slowing of bodily functions to the point of torpor during summer. Certain plants drop their leaves and become dormant to avoid water loss. Little growth takes place until the rains come again. This brief story of three biomes of Africa and some of the animals that live in them doesn't pretend to be complete. At best, it is a superficial glance at what is the last great reservoir of wildlife on earth. The savannah, rain forest and desert, all are living laboratories of ecology. Here, in the wilderness, one can see the end result of three billion years of trial and error, of mistakes and successes, in the deadly serious game of evolution.

Asia

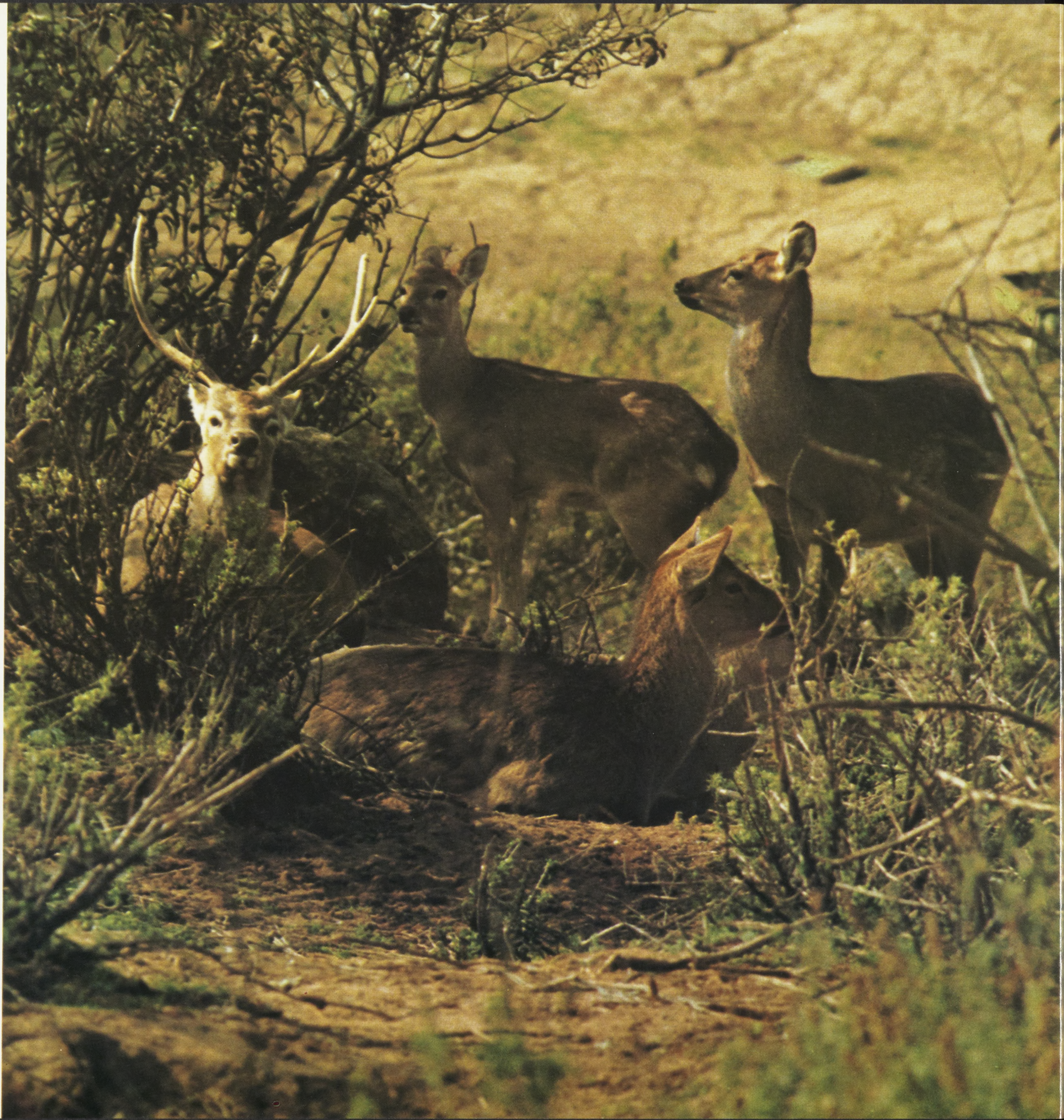
Whereas Africa has been geologically stable for six hundred million years, southeastern Asia—India, the Malay Peninsula, Indo China and the thousands of offshore islands—is a late comer on the scene. Just sixty million years ago, a mere eyewink in geological time, India was an island and much of the adjacent mainland was experiencing intense volcanic bombardment. This fact of geological instability has been of great importance in shaping much of southeastern Aisa's life forms—plant and animal. Elsewhere on earth, where relatively stable conditions exist, life is able to migrate. Over thousands of years, these migrations act as equalizers, providing infusions of new blood, and leveling out the extremes of evolutionary experimentation. The development of life is kept along the main-

Formosan Sika Deer fawns keep their eyes on an Adjutant Stork.

Hog Deer. This is one of the smaller deer. It lives from southeastern Asia northward into China. It stands only 25 to 29 inches tall at the shoulders. Unlike many other deer, it tends to live a relatively solitary life.

stream. Those species which fit in well, thrive not only in their place of origin, they also migrate to fill comparable niches elsewhere. The slow, seemingly haphazard process of evolutionary development owes much to the ability of life forms to migrate. But in an area of instability, such as the islands off southeastern Asia, a different situation prevails. The evolutionary checks and balances which exist on large, continental land masses are absent, and strange lines of development often take place. Of course, as elsewhere on earth, the single most important determining factor in the kinds of plants and animals which exist in southeastern Asia, is the biome. All of the area, excepting the northern part of India, lies in the tropics, so is spared the extreme changes of temperature which exist elsewhere. It is



Formosan Sika Deer. A medium to small deer found on the island of Formosa. Height at the shoulders is about three feet.

Right, Sarus crane. This largest of all cranes (50 inches) lives in India, Burma and Thailand.

always warm and whatever seasonal changes there are, consist in the amount of rain which falls. Like East Africa, southeastern Asia has two wet and two dry seasons each year. In July, heavy rains sweep through the entire area. Then, in January, the islands are deluged a second time. These monsoon rains make parts of southeastern Asia among the wettest places on earth. Cherrapunji, India, receives more than 400 inches of rain per year, and the average annual rainfall of Asian lands which lie near the equator is from 80 to 120 inches. By comparison, San Diego normally gets 10 inches per year.

RAIN FOREST AND SWAMPS

Because of the heavy rainfall and the warm even temperatures, the dominant vegetation type of southeastern Asia is trees—either rain forest or monsoon forest. The rain forest, as in Africa, is a dense growth of evergreen trees. Much of the land beneath the trees is swampy, a mixture of the vast amounts of runoff water from the mountains and the silt which it carries along. Monsoon forests are unique to southeastern Asia. They are deciduous, that is, they shed their leaves. But, unlike deciduous forests of northern lands which drop their leaves during cold weather, the monsoon forests become dormant during the dry season. In the rain forests and its swamps, much of animal life stays aloft, out of the water. Consequently, it had adapted to arboreal life. Some of the smaller animals get around in the trees by "flying." There are so-called flying squirrels, lizards, frogs, and one creature, the terrier-sized colugo. Each has a webbing of skin that it spreads as a membrane on which to glide or "parachute" from place to place. There is also said to be a flying snake which "flies" from one branch to another or to the ground by pulling in its belly and spreading its ribs. The rain forest supports a wide variety and large number of primates, including several species of monkeys. One, the proboscis, which is found only on the island of Borneo, is named for the large, pear-shaped nose found on adult males. The older the animal, the longer and more bulbous the nose is apt to be. Two of the four species of anthropoid apes—those which closest resemble man—are found in southeastern Asia. The smaller, the gibbon, lives throughout the forests of the Malay Peninsula, Indo China and the offshore islands. Gibbons, without a doubt, are the world's champion acrobats, swinging and leaping through the trees. The second anthropoid of the area is the orangutan. Unlike

the wild, free gibbon, orangs are slow and deliberate as they move through the trees. Of all anthropoids, the orangs are the most arboreal. They spend most, if not all their lives high in the rain forests of Borneo and eastern Sumatra. In former times, they were widespread throughout southeastern Asia and even on the mainland. But they have been persecuted by man for thousands of years. Today, their habitat and numbers are small, and the prospects for their survival in the wilderness seem slim. Some of earth's rarest animals, the three species of Asian rhinoceros, are found in the swamps. These three, plus the two African species are all that remain of a sixty-million-year-old race whose time appears about finished. Certainly, Asian rhinos are teetering on the edge of extinction, especially the Javan and Sumatran species. The Indian rhino's numbers are larger because it is protected by the government. This rhino is the classical, "armor-plated" animal of legend. One of the most striking mammals of the Asian swamps is the Malay tapir, a handsome black animal with a snow-white "saddle" of hair across its back. The only other place where tapirs occur is in Central and South America. Probably, both the Malayan and American species stem from the same ancestors. These two animals, separated for tens of thousand of years, could have evolved in quite different directions. But they did not. The only major difference is in the color of the adult pelage—the coat. Young Asian and American tapirs look alike—little watermelon-striped creatures. The fact that both species live in almost identical biomes—warm swamps—has dictated the direction of their development. In nature, if a life form has adapted well into its ecological niche, and if that niche remains stable, the animal or plant which occupies it can remain unchanged for thousands of years. Thus both Asian and American tapirs have changed little from the original stock. Among the larger deer which live in Asian swamps there is milu, or Pere David's deer. Milu is not a native of southeastern Asia, but the story of his survival is so dramatic that it deserves inclusion. A few hundred years ago, milu lived in the swamps that border the rivers in central and southern China. Even in those days, wild animals were in danger of extinction

Opposite, Himalayan Tahr Goat. Found in the most inaccessible areas of the western Himalayas, these reddish brown goats live in herds except in late summer when the old males drift away on their own. *Right,* Hooded Crane. A few hundred of these birds still live in Japan and Siberia. They are on the Red List, a list of endangered species published by the International Union for the Conservation of Nature and Natural Resources.

because of man. Milu faced overhunting from poachers. When the emperor learned of this threat, he drove a herd of the animals into a royal hunting preserve. Although the emperor's motive was to keep himself supplied with deer for hunting, the net effect was an act of charity for milu, for shortly thereafter, the deer became extinct in the wilderness. It was in this preserve that Father Armand David, a French missionary/naturalist, saw it, the first white man to do so. Eventually, a few were sent to a European reserve. The Boxer Rebellion destroyed the imperial hunting grounds and most of the herd with them, and the rest of the animals still in China were killed within the next twenty years. The only living specimens of milu were on a game reserve in England. Fortunately, they reproduced well, and in 1960, a few were returned to China. Today, milu, or Pere David's deer, can be found in many zoos and preserves around the world. There are other deer in the Asian swamps, as well as some species of wild cattle. The best known of the latter is the water buffalo, a creature which has been domesticated for centuries in Asia. It still is the principle beast of burden there. Where one finds deer and other herbivores, he may expect to find predators. In the swamps, the main carnivores are tigers, leopards and, in the rivers and coastal estuaries, crocodiles. Tigers live throughout the rain forests and swamps of southeastern Asia and well north into Siberia. The southern group, the Malayan tiger, is the smaller of the two. Its northern counterpart, the Siberian tiger, is the largest of all cats.

THE PLAINS

Rain forests and their adjacent swamps constitute the dominant biomes of southeastern Asia. There are others, of course. One of the largest is the plains, or monsoon forest. It covers a large portion of the interior of India and is roughly comparable with the African savannah. The one, true Indian antelope, called a blackbuck, lives on these plains. Blackbucks are almost exclusively grazers and perform the same function as their African counterparts. The nilgai is the largest Asian "antelope." Mature males can weigh four hundred pounds and more. The chief natural enemies of

Opposite, Nilgai. This animal is one of the more common Asian plains antelope. *Left,* Saiga. Once almost extinct, the Saiga has increased its numbers into the tens of thousands because of protection.

the nilgai are leopards and lions.

As discussed earlier, leopards are found from the southern tip of Africa to northern Siberia, at sea level and high in the Himalays, in humid rain forests and on the desert. The two most beautiful forms are the clouded leopard, a creature of southeastern Asian swamps, rain forests and plains, and the snow leopard, which lives in the mountains of Siberia and Manchuria.

It might seem surprising to find the lion, an animal which is so closely associated in popular thinking with Africa, living in Asia. Yet at one time, lions lived throughout Africa, southern Europe, the Near East and well into Asia. By the time of Christ, they had been exterminated from Europe, and in the ensuing years, the Near Eastern and Asian groups were killed off. Today, only a tiny population still lives in India. This group, numbering, perhaps 250 animals, live in the Gir forest, a game reserve of about 5000 square miles.

There are other predators in southeastern Asia—several species of small cats, and members of the dog and hyena families. Among the dogs, there are jackals, foxes, wolves and dholes. The latter two deserve mention.

The Indian wolf is leaner and smaller than his American and European relative. Probably the slimming down was an adaptation to the reduced food supply on the semi-arid Indian plains. It is this wolf of India, who played such an important role as Akela in Kipling's "Jungle Book."

Another of Kipling's characters is the dhole, or wild dog. Dholes, as wolves, travel and hunt in packs. They have been known to contest a kill with a tiger and to win. Dholes, in one form or another, live across India, down the Malay Peninsula and onto a few of the larger islands.

As mentioned earlier, one of the two living species of elephants lives in southeastern Asia. They are found in just about every biome from rain forest to plains. Asian elephants are smaller than the African species. They have smaller ears and larger heads; their faces seem concave as compared with the convex faces of the African species; they appear chunkier than the Africans; they lack the prominent, "humped" back posture; and finally, only the males have well developed tusks. Both sexes of African elephants have tusks.

Indian elephants have been domesticated for many centuries. Most zoo and circus elephants are Asian.

As in the African section of this book, there has been no attempt to cover the animals of southeastern Asia in other than a superficial manner. There are many species of creatures living in

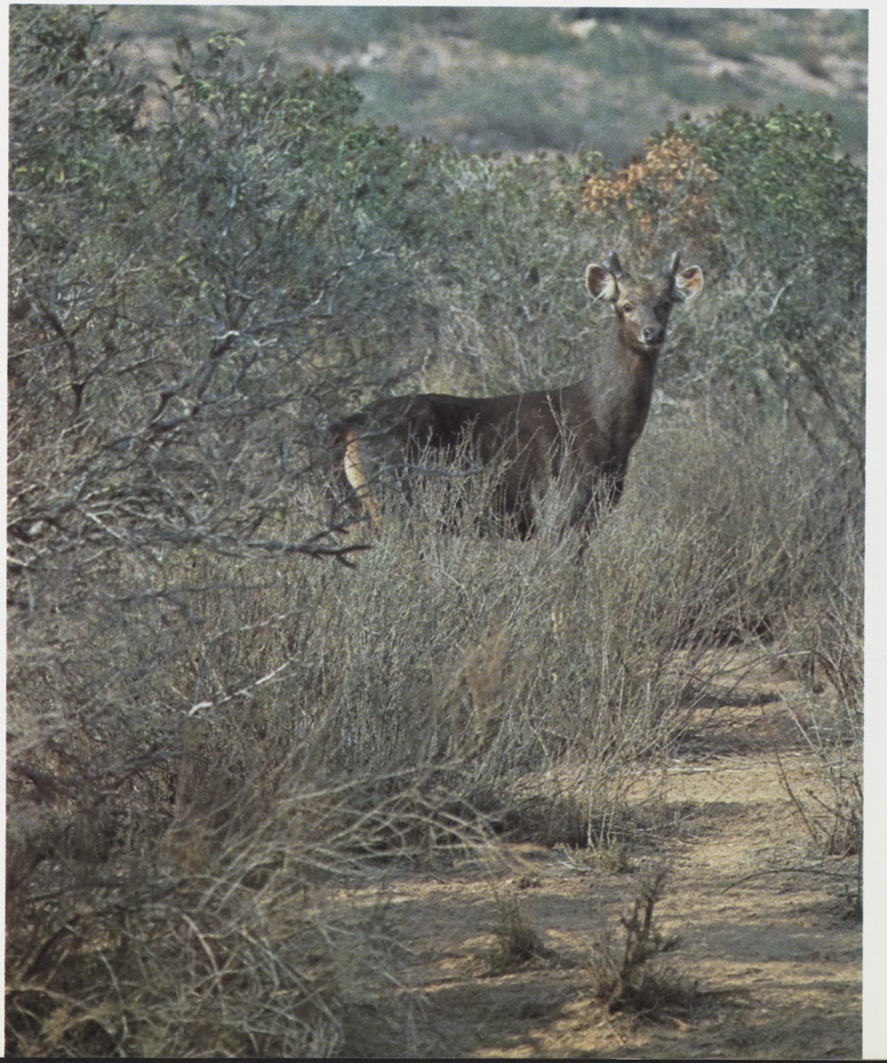
Blackbuck. This dark brown and whitish antelope lives on the plains of West Pakistan and India. Only the male has horns. Blackbucks compare with the Impala of Africa in their ability to leap, and when frightened bound away after being warned of danger by one of the females in the herd.

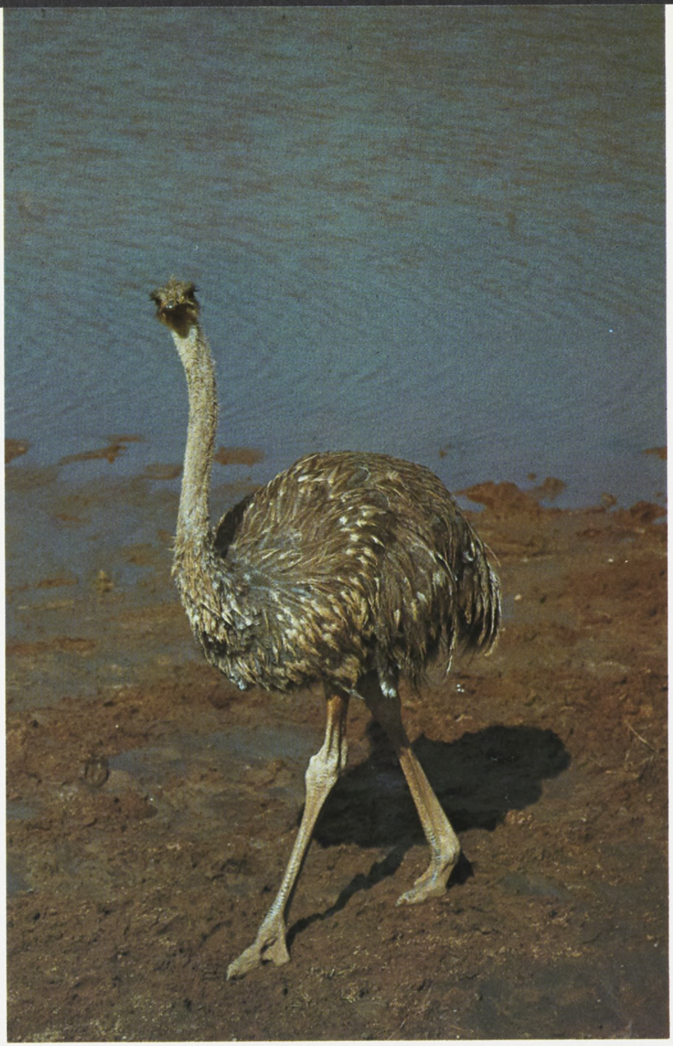
The Water Buffalo, still found in the wild in southeastern Asia, also is used as a beast of burden.

this warm, verdant corner of the earth. Insects, reptiles, fish, birds. One of the more fascinating aspects of the area, especially the islands, is the sometimes bizarre evolutionary directions which certain species have taken. Earlier, mention was made of what can happen on an island, isolated from a continental land mass, and the migration of life. One of the contributing factors to insular evolution is the absence of the usual complement of competitors. On large land masses, the most efficient form of life wins the brass rings—that is, it gets to inhabit an ecological niche. "Efficient" means several things—first, the ability to survive the vissicitudes of natural selection. There are always predators waiting to take the animal which can't defend itself or hide or run away. "Efficient" also means the ability to adapt to changing climate, to new migrants, to subtle shifts in the overall balance of the biotic community. So the efficient form of life is that which stays flexible enough to do whatever needs doing in evolutionary terms. But on an island, the rules are changed. First, most of the islands of southeastern Asia lie in or very near the tropics; there are no great changes of temperature. Also, on these islands, there has been little if any significant migration in thousands of years. The biotic community has become stagnant, in that the balances are stable. Whatever predator existed there once upon a time, is still the predator which must be coped with. No need to adapt to new hunters. This excepts the arrival of man, of course. He introduces a unique, and all too often, tragic, element into the evolutionary game. So, life on these few islands stays very much as it has been for thousands, perhaps millions of years. And, without the need to stay alert in evolutionary terms, some rather unusual things happen. For instance, there is a monitor lizard which lives on three tiny islands in the chain of southeastern Asia islands. It has become a giant. Monitor lizards elsewhere in the world are two or three feet long. On the islands of Rintja, Padar and Komodo, they grow to twelve feet long and weigh three hundred pounds. These giants are called Komodo dragons, and are the largest lizards on earth. At the opposite extreme from the giantism of the Komodo dragons, are the anoa of Celebes Island. Anoa are wild water buffalo, closely related to the mainland buffalo. On the continent and other islands, buffalo stand about six feet at the shoulder; anoa are slightly more than three feet. They are the world's smallest wild cattle. Why should one island produce giantism and another create dwarfs? Nobody knows. Insular evolutionary development is much less predictable than that which occurs on the continents. Australia, for instance, is an island where placental mammals failed to develop. Most mammals, including humans, reproduce by gestating their unborn babies in a uterus which is lined with a placenta—a spongy tissue that acts as the transition zone between mother and baby. Animals having this tissue are called placental mammals. In Australia and Tasmania, mammals evolved as marsupials. Their babies are born at a very undeveloped stage of life, then

make their way along the mother's body to her pouch—the marsupium—where they fasten onto a nipple and complete their development. All ecological niches normally filled elsewhere by placental mammals are occupied by the marsupials in Australia. There are tiny marsupials who perform the same function as rodents. Kangaroos are the "deer." There is even a marsupial predator, or was until man exterminated him. He is the Tasmanian wolf who looked like and behaved very much as his namesake. There is another island group which deserves mention although it is not in Asia. It is the Galapagos, a cluster of volcanic islands off the west coast of South America. It was in the Galapagos that Charles Darwin became acutely aware of the process which he later called "natural selection," and which formed the basis of his famous book, "Origin of Species." The unique adaptation of plant and animal life which Darwin observed on the Galapagos, convinced him that life is a dynamic, ever-changing phenomenom, responding to the environment in which it exists. It was the most radical kind of thinking, and it exploded on the nineteenth century mind like a bombshell. Darwin was damned by the vast majority of people and supported in his thesis by a mere handful. But the validity of his vision could not be denied, and the theory of evolution which he propounded is one of the foundation stones in today's life sciences.

As recently as the end of the last century, the Gaur, *opposite left,* had an extensive range throughout India and Indo-China. Today, its numbers and range are much smaller. Père David's Deer, *opposite right,* was extinct in its native China for more than fifty years, but has recently been reintroduced from a herd in England. Sambar, *left,* are found in the tropical forests of southeastern Asia, whereas Axis Deer, *right,* also of the Asian subcontinent, tend to shun heavy forests.





Ostrich

White Rhinoceros

At the Waterhole

Just as the sun is a necessary source of energy for manufacturing food, so water is vital as the universal solvent which dissolves that food into form. All living creatures must have water. Some, such as cacti among the plants, and certain rodents, such as the kangaroo rat, among animals, seem to need very little of it. Cacti extract it, molecule by molecule, from the sand. The kangaroo rat probably never actually drinks water, getting all he needs from his food. But even these two inhabitants of earth's most arid zones, cannot exist without access to some water. For most wild animals, a source of water is absolutely essential for their continued existence, and they will travel many miles to find it. On the savannah, this source usually is the waterhole. Creatures of many species gather and drink side by side. This is not to say that here "...the leopard shall lie down with the kid." But if there is one spot in the wilderness where ancient antagonisms seem to be set aside for a brief time, it is at the waterhole.

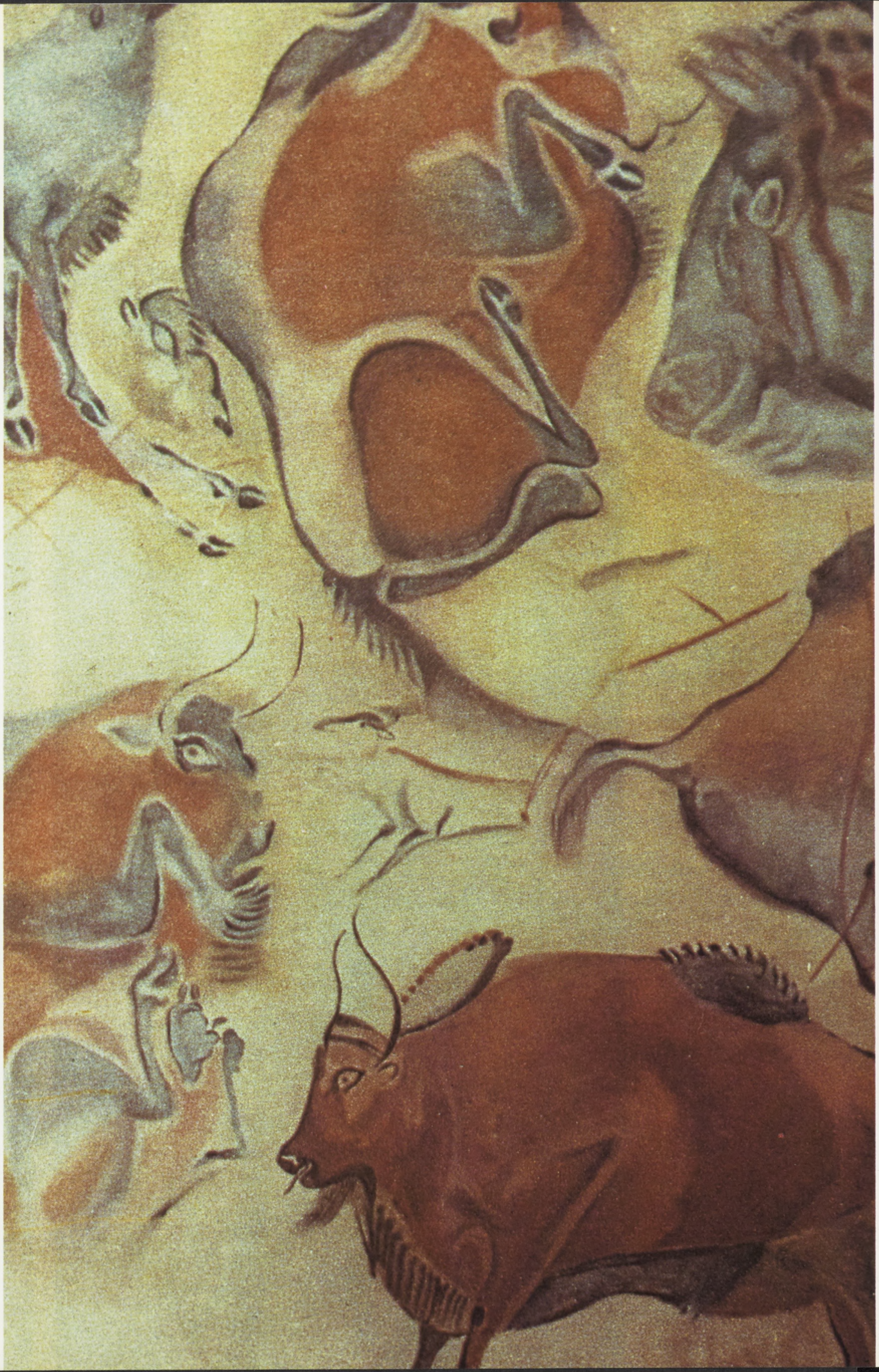
Kob

White-bearded Gnu

Eland

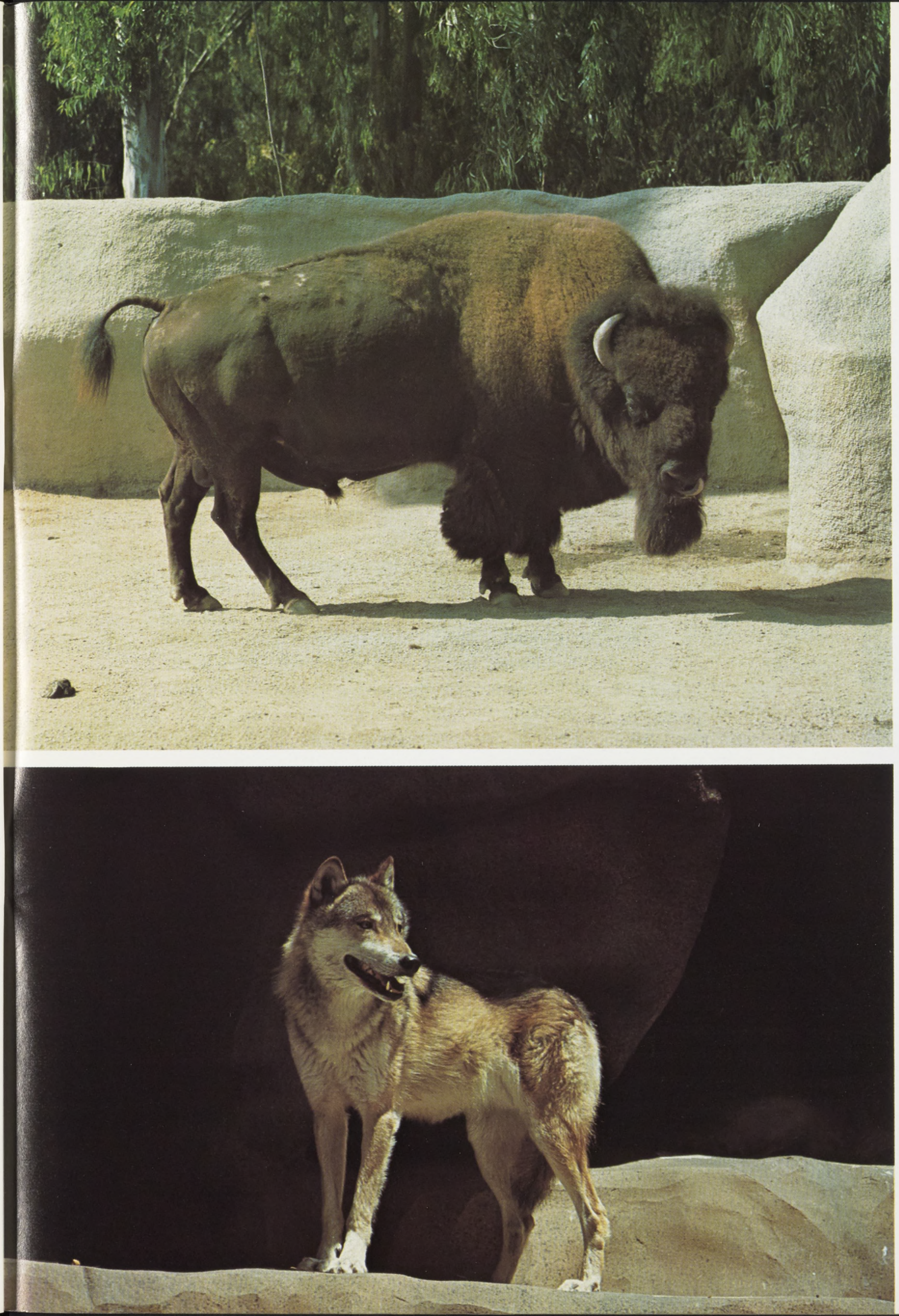
Man and Nature

For all but the past few thousand years of man's two million years on earth, he was a hunter. Where the game herds led, he followed. In spring, as they moved north to the summering grounds, man trailed along. And when winter forced the animals south, man moved with them. He was a predator among the other predators which lived off the herds. About forty thousand years ago, he went with them eastward across the land bridge which joined Asia to America, and became the first humans in this new land. Perhaps because of his close association with the animals, man developed special feelings for them. In some societies, they were deified; in others, they were considered kinsmen, "brothers." When man lived in caves, he painted their pictures on the walls, believing that this would guarantee a good hunt. He ate their vital organs, assuming that by this



Beginning about thirty thousand years ago, primitive men inhabited the Altamira Cave in northern Spain. And throughout its occupancy, the cave—especially its ceiling—was the "canvas" on which these Neolithic people painted pictures of the wild animals. Some—such as bison—were their prey, and perhaps were painted as magic to ensure success on the hunt.

European Art Color, Peter Adelberg, N.Y.



Bison and Wolf. These two lived in large numbers as predator and prey before white men came to the American Great Plains. They lived in balance with each other—the wolves keeping the enormous bison herds culled of diseased and otherwise infirm animals, and the bison supporting the correct number of wolves to maintain, but not deplete, the herds.

magical rite the animals' strength or courage or cunning or whatever attribute they seemed to display, would be passed on to the eater. The wild animals were as much a part of man's life as the air he breathed and the water he drank. Then, about eight or nine thousand years ago, man discovered that he could get far more food, far easier, by herding animals than by hunting them. Man the hunter became man the pastoralist. At about the same time, he discovered that instead of going out to gather plant food, he could cultivate it in a garden. Agriculture was invented. With these two discoveries—herding and farming—man began the long road toward civilization. The end result of that process is what we have today—great cities, technology, and highly developed culture. Because of it you and I can lead relatively comfortable lives. We owe much to those first, tentative steps towards civilization. But we have paid a price for them. It is a truism in nature that there are no free rides. Everything has a price tag. Today, we see the price we pay for the uncontrolled technology—polluted air and water, crowded, noisy cities and highways. There is still another price we have paid for our civilization—a change in our attitude about wild animals, those whom we formerly called "brothers."

Perhaps the case of wolves will dramatize this. When he was a hunter, man accepted the wolf as a fellow predator. The two species really didn't compete with each other, for their hunting styles were different. They occupied separate ecological niches. By and large, man admired the wolf for his wisdom and courage. The bravest warriers and the most cunning hunters were named for the wolf. But after he became a herder of domestic animals, man's attitude regarding his old hunting companion underwent a dramatic change. It was one thing to admire an animal who hunted the game herds so efficiently. It was quite another when those same skills were turned against cattle and sheep. He who had been an admired fellow predator, suddenly was seen as the enemy. Man declared war on wolves, a warfare which still is going on, thousands of years later. Why did the wolves turn to killing domestic animals? The main reason was that man, in clearing forests for timber and in plowing up the grasslands for farms, eliminated the natural prey. The deer and bison which the wolf hunted were killed, leaving only domestic animals. Just about all wild animals slipped from favor after man discovered herding and farming. The predators killed the cattle and sheep; the herbivores competed with them for forage. Man changed from a creature who had lived easily for hundreds of thousands of years with animals to one who fought them. Today, the single greatest threat which man poses to wild animals is the destruction of their habitat. Forests are cut; prairies are plowed under; wet-

San Diego WILD ANIMAL PARK

Behind the scenes at San Diego Wild Animal Park. *Above,* unloading a White Rhino. *Center left,* uncrating an antelope. *Center right,* medicating an injured zebra. *Below,* the Jerene Appleby Harnish Wild Animal Station for Medical Care and Research. *Opposite,* White Rhinos at sunset.

lands are drained and filled; and rivers and lakes are polluted. Wild animals took millions of years to adapt into their separate niches; they cannot change to fit new ones as rapidly as man destroys the old. So they die. Each nine months, a species of plant or animal becomes extinct.

So what? What difference does it make if every wolf, lion, deer, antelope, alligator, and whatever, dies? What have we to do with them anymore? The old days are gone. We no longer need them as we did those thousands of years ago.

That is true. We do not need the wild animals as we once did. But that does not mean that we do not need them at all.

There are many reasons that wild animals deserve to live and reproduce their kind. Some, as seen from the human standpoint, are admittedly selfish. There is much we can learn from them that will contribute to our own welfare. Already, many medical discoveries have been made, thanks, in large part, to studies conducted on wild animals. And now, through the relatively new science of ethology—the study of behavior—we are beginning to learn how animals live together in their natural environments. The scientists making these studies think that there could be applications to the way in which we humans might better our own relationships. Another selfish reason for saving wild animals, especially some of the large, African antelope, is that they could eventually supply a reliable source of protein for humans. Domestic cattle fare poorly on the semi-arid savannahs. But the native antelope, feeding on the very same grass, are sleek and fat. Perhaps these animals could be substituted for the cattle some day.

Over and above these human-centered needs, wild animals, and the wild places they need in order to live, have the right to exist simply because they do exist. They have been our neighbors on this planet for two million years. They predate our relatively late arrival. And they are parts of the fabric which we call life. Pulling out any one of the parts can place the entire fabric in danger, for, in nature, all things are related to many other things.

Mankind needs animals in the wilderness as living reminders of his past. Despite his technology and civilization, he is still very much a part of earth's natural processes. Wild animals can remind him of this. Even if he never sees them in the wilderness, there is great comfort in knowing that they are out there.

We must set aside areas where they can live. We must stop the senseless killings. We must learn more about the animals' habits in order to protect them. And we must rediscover those ancient attitudes, the ones we held in the days when we followed the game herds north in spring. They are not dead. Somewhere under the overburden of modern, twentieth century concerns, they are still very much a part of us, needing only the freedom to live.

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